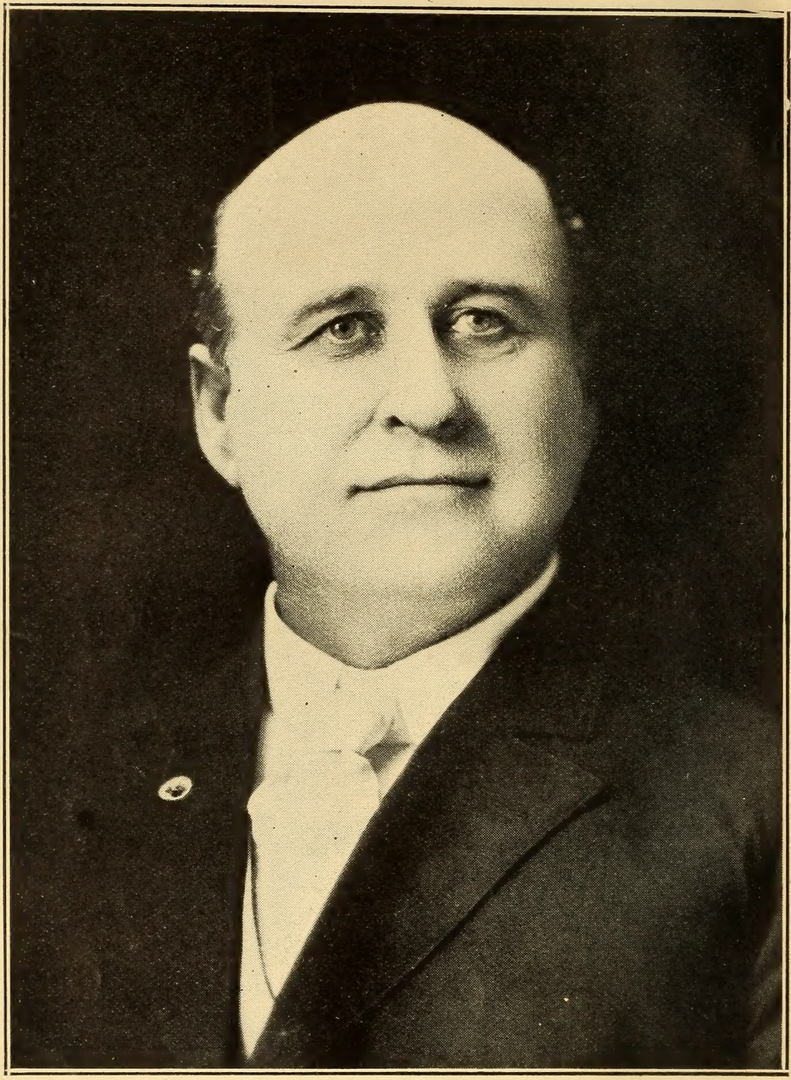
SPINAL TREATMENT



Yours Very Truly
Alva A Gregory M.D.

Spinal treatment; auxiliary methods of treatment designed for the use of those who believe in and appreciate the true principle of progress in the healing art, namely, try all things with an open mind, and hold fast to that which is found to be good,

by

Alva A. Gregory, M.D.

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Oklahoma City, Oklahoma.

The Palmer-Gregory College

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THIS VOLUME IS DEDICATED
WITH PROFESSIONAL COURTESY
TO
PROFESSORS OF THE HEALING ART
MY COLABORERS IN COMBATING THE INROADS OF
DISEASE AND IN RELIEVING HUMANITY
OF PAIN AND SUFFERING
BY
THE AUTHOR

To replace lost copy
May 20/07

PREFACE TO FIRST EDITION.

THE main object in view in the preparation of this volume has been to explain a special method of treatment and to place that method upon a scientific basis, since we feel that it will prove an important auxiliary to the present methods of the practitioners of the healing art, who have by an expenditure of time and money prepared themselves for their lifework of combating disease.

I am aware that many may differ with me in many of the statements made, before they have fully tested their correctness; also, that unintentional and unavoidable errors have crept into the text.

This work, especially the first section, is entirely along new lines of thought. Having no precedent, considerable repetition has crept in, and we find it very difficult to eradicate the same without the expenditure of much time; besides, the repetition will serve to impress many of the important fundamental principles; and we feel sure that this volume will be of great interest to any one of an investigating turn of mind.

We are too close upon the heels of such remarkable discoveries as the phonograph, the telephone, the aeroplane, and wireless telegraphy, to prejudge and criticise any new invention or discovery.

Before Edison's marvelous discovery and invention of the phonograph, who would have believed the possibility of reproducing the human voice from a machine? It is truly a marvel, but it is now an accepted fact.

Who, then, is sufficiently wise to say what the next great discovery is or will be? It may be in the healing art, and those who have investigated spinal adjustment declare that it is.

The author, during the past three years, has given himself almost wholly to an investigation of the merits of this science, that before, to him, were entirely unknown. In our research we have made it our primary object to test the merits of spinal adjustment as to its efficacy and potency as a means of relieving disease, both acute and chronic.

The confidence the author has gained in this method is based upon special relief and removal of some ailments in his own case and the results that he has obtained in testing it upon hundreds of others afflicted with many different ailments. Many of the results obtained have been indeed remarkable—in fact, almost incredible—and very far exceeded his most sanguine expectations.

It is the earnest desire of the author of this work to add an humble mite to the store of knowledge of the medical world, and to urge all physicians, whatever their school or training, to inspect this volume with the same spirit with which it has been prepared.

Many are losing confidence in the regular practice of medicine of to-day; many discrediting statements are made concerning the use of drugs. The following is quoted from Dr. Oliver Wendell Holmes, forty years professor of anatomy in the Harvard University Medical School: "Mankind has been drugged to death, and the world would be better off, if the contents of every apothecary shop were emptied into the sea, though the consequences to the fish would be lamentable."

Dr. A. C. Bernays, M. D., of Marion-Sims College, St. Louis, Missouri, says: "To give drugs to a well man is very wrong, but to give drugs to a sick man is nothing short of a crime."

Dr. Evans, M. D., of Royal College, London, says: "The medical practice of to-day has neither philosophy nor common sense to commend it to our confidence."

Dr. J. B. S. Allyne, M. M., Barnes Medical College,

St. Louis, Missouri, says: "Of all branches of learning, medicine is the most uncertain. Physic is the art of amusing the patient while nature cures the disease."

The above quotations from men of our own ranks and of high standing therein are at least indicative of one important fact, and that is, that we have not yet reached a scientific and sufficiently successful system of treatment to command the respect of even our own profession, to say nothing of the failure of maintaining the full confidence of the laity.

It is no wonder that so many people are losing confidence in our professional efficiency, and no wonder so many charlatans live and prosper.

I am fully persuaded that we, as a professional medical body, owe it to our self-protection and the maintenance of our standing in the confidence of the laity, to live up to the true principle of progress in the healing art, viz., to "investigate every method of treatment that may accomplish good, with an open mind, and to hold fast to that which is found to possess true merit." This is the only method by which we will hold the confidence of the people. The best educated class of people to-day who offer to practice the healing art should possess every meritorious method, adjunct, or auxiliary that may be expediently and effectively employed.

We believe that any treatment that has merit, as a palliative or as a curative agency, should be known to the medical profession, who are educated and qualified, first, to understand its merits; second, to make a proper use of it; and third and lastly, to develop any adjunct of merit so as to increase the amount of its potency and also the usefulness thereof.

In the study and practice of this new system of treatment, we have found a solution for many things that were, to the author, unknown before.

Many questions are, to our mind, now fully explained

that before were mysteries, and for this reason we believe that a full explanation should be given to and enjoyed by the medical profession.

Hydrotherapy, the water cure, was first introduced and used by an uneducated class outside of the medical profession. Since the medical profession have adopted this treatment as an auxiliary method they have greatly improved the former procedures of hydrotherapy and made it a much more potent auxiliary.

One of the author's former teachers, Dr. J. H. Kellogg, of Battle Creek, Michigan, was dissatisfied when he graduated as a water-cure doctor, feeling that he knew entirely too little to offer his services as such. He applied himself diligently to the study of medicine, and after this educational preparation he has accomplished more than any other living physician in the development of hydrotherapy and its practical modes of application.

Electricity was used as a remedial agent by men outside of the medical profession, but afterwards it was accepted by the medical profession because it was found to possess some merit, and since then it has been by them wonderfully improved, and to-day is recognized as a remedial agency of practical utility, and is now in quite general use.

For the foregoing reasons, we believe that if the medical profession investigate the work of spinal adjustment, that this too will be added as another auxiliary, and we confidently believe that it will be the greatest adjunct that has yet been offered, especially after it has been in the hands of and improved by this intelligent and able body of physicians, who, we fully believe, will not fail to greatly develop and improve it.

We believe further that the spinal adjustment treatment in the hands of the ignorant (although the method is meritorious) will retrograde and fall, more or less, into disuse.

Should educated men outside of the medical profession espouse and uphold this method, they would establish and maintain another distinct system of healing at variance with all others, and an incomplete system, except surgery, obstetrics, and other things, would be added. Another system would only engender confusion, and cause loss of confidence and disrespect for the regular medical practice or any other system. Let me advise you, my fellow-physicians, to obtain and possess every potent auxiliary method of treatment, and the confidence of the laity will be retained by us and we will be the more capable of their full confidence and appreciation.

Finally, we wish to call the attention of the medical profession to one special point concerning the adaptability of spinal adjustment as an auxiliary expedient in their general practice. In the use of hydrotherapy we of necessity must have considerable facilities in the way of bath equipment, that we may apply the different methods of application of hot and cold water, and also considerable labor and assistance are necessary.

In the administration of electrical treatment it is necessary to have expensive apparatus that requires considerable room, and also time and experience to apply it with any degree of success.

Again, osteopathy consists of more than half a hundred different methods of procedure and it requires considerable strength and time to apply this treatment to a patient. Besides this, much of the work of the osteopath is done by routine, without any practical object in view, save to follow out the instructions of their educators.

But in giving spinal adjustment the equipment is quite inexpensive and may be prepared at a trifling cost and used without any assistance. In spinal adjustment the work is very specific. We make no move, give no thrust, make no adjustment, except for a

specific purpose. Much less physical exertion and labor are required, and also very much less time consumed.

Much more can be accomplished by spinal adjustment in from one to two minutes' time than can beaccomplished by electricity, hydrotherapy, osteopathy, or any other auxliary system in an hour's time.

This advantage, we feel, will cause the work of spinal adjustment to appeal much more to the practitioner than the other cumbersome and laborious adjuncts just mentioned.

We believe that the greatest work of the author's life will be to assist in making a humble contribution to the knowledge of the medical fraternity, that will aid us in our work of relieving pain and suffering, and in this way contribute to the welfare of the laity, who look to us for the care of their health and the prolongation of their existence.

ALVA A. GREGORY, M. D.

PREFACE TO SECOND EDITION.

THERE is an evident necessity that the physicians and surgeons of the present time possess a proficient knowledge of the cause, indications, and results of spinal lesions, and also the more effective methods of removing them and their effects.

Lack of a competent knowledge of this subject may lead to our humiliation by the work of uneducated persons, who often obtain successful results in the treatment of many diseases, by spinal adjustment, that will not yield to our ordinary methods of medical and surgical treatment.

We have reached an age of advancement when it is unwise, upon the part of the leaders in the practice of the healing art, to ignore or pass without due consideration, any newly discovered methods of diagnosis or treatment which are based upon reasonable principles and rational methods.

The true principle of advancement in the healing art is to investigate all reasonable methods of treatment, with an open mind, and to hold fast to those which are found to be good.

We are aware that erroneous teachings, concerning the science and philosophy of spinal lesions and spinal treatment, have been a potent cause in driving intelligent people to disbelief and even disgust, yet we know there is a correct philosophy underlying this science, and that there is potency in the remedial agency of spinal adjustment, and that wonderful results follow its application, even though the treatment be given by some with limited education and in an empirical way.

We know that we are in need of auxiliary methods of treatment, and this is evidenced by the fact that most

chronic diseases are not amenable to our ordinary methods of medical and surgical treatment, and so-called self-limited diseases always run their course; while, under spinal adjustment and other rational methods, acute and the self-limited diseases, so called, are cut short and aborted, and chronic cases recover, which have ever been believed to be incurable.

Our first effort to get this new science or method of treatment of spinal lesions before the profession has met with unexpected success and we hereby acknowledge our gratitude, and we trust in this volume to merit your further appreciation and continued support.

In the preparation of this work we have consulted the following works: Gray's Anatomy, Cunningham's Anatomy, Clark's Applied Anatomy, Landois' Physiology (edited by Brubaker), Spondylotherapy, by Abrams, and other text-books.

We are indebted to many practitioners of spinal adjustment, for points on methods of procedure in relieving contractions of the musculature of the spine. We especially thank Dr. Oakley Smith, Chicago, Illinois, Dr. J. Franklin Balzer, Pasadena, California, Dr. Walter Harmer, Burlington, Iowa, Dr. J. Alfred Coultrap, Colorado Springs, Colorado, Dr. George Olsen, Dr. D. Chaliss Faust, Philadelphia, Pennsylvania, Dr. P. E. Erickson, Salt Lake City, Utah, Dr. George B. Abbott, Los Angeles, California, and others, for methods of adjustment, and to those mentioned and others we are indebted for many of the methods described and illustrated in this work.

We especially call your attention to a new feature of spinal treatment by spinal percussion. This method has been used by the Japanese in the resuscitation of persons who have recently been made unconscious from accident or shock or from heart failure. Dr. Abrams has done much investigation and has given us much information in his able writings and we are glad that after several

months of investigation that we can concur with him, after verifying the truthfulness of his claims by clinical experience.

This work is in line with spinal adjustment and constitutes one of our most potent auxiliary methods of Spondylotherapy, and we are glad to indorse and give you briefly much information along this line.

In our next volume, which is being prepared while this work is in the hands of the printers, we wish to give more fully the symptoms and the auxiliary methods of drugless treatment for acute and chronic disease, believing that such a work will be of great value to the practitioners of rational methods of drugless treatment.

We wish you to kindly overlook any and all shortcomings, and to write us your criticisms and to proffer us suggestions for improvement in subsequent editions.

ALVA A. GREGORY, M. D.

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1. The principles underlying the science of spinal adjustment are as old as the vertebral column. Probably the contraction of muscles and ligaments along the spine, when irritated, have ever caused an approximation of the vertebræ, which causes a narrowing of the intervertebral foramina, and consequently an interference with the normal nerve supply to the different organs and parts of the body. This has been true, undoubtedly, to a greater or less extent, from the beginning of the human race.

2. Since the creation of man we have no evidence of a change in the histological or anatomical organization of the nervous system, nor of the direct or indirect action of the same or any organ or part of the body, save a diminution in the size of the organic structures and functional decrease in strength.

3. The knowledge of some of the facts concerning spinal adjustment and the knowledge of some of the principles were partially obtained before the author's day. The history of the beginning of this method of treatment is largely buried in obscurity.

4. Although this practice has been in vogue in Northern Europe, especially in the Bohemian country, for near a hundred years, yet it is even now practically unknown in the greater part of the United States.

5. From Professor Yawger, of the University of Pennsylvania, we learned of the use of spinal manipulation and spinal adjustment by the Germans in their fatherland before it was known of or used by the Bohemians in their native country.

EARLY HISTORY OF SPINAL ADJUSTMENT.

1. During the past century some of the Bohemians have obtained decided constitutional effects and it is claimed they have restored many invalids to health by their system of giving thrusts and other methods of making spinal adjustment. This practice has been in Europe, as it has been in the United States so far, with few exceptions, in the hands of ignorant and unlearned advocates, and consequently is now known to but few of those people who are educated in therapeutic lines.

2. The purpose of the Bohemian manipulations was for the relief and cure of disease, both acute and chronic. And it is said they have been used also for the purpose of resting and refreshing a person after continued tiresome labor, and were so used because of exhilarating effects that would follow the application of this mode of treatment or procedure.

3. It seems that the promoters of some of the more violent sporting games have in some way gained information concerning the effects of spinal treatment.

For years the football players of America have been using a crude and empirical treatment of the spine in emergency cases during football games. When a member of the team suffered from a jam or blow that would knock the breath out of him, four of his comrades would take the injured player, one holding to each extremity, and stretch him upon the ground, face downward, while the fifth party would punch or pound the spinal column on either side of the spinous processes, and in this manner they would restore his heart action and respiration, or relieve the cramping produced by the shock or blow. In this way they would soon restore him to the game.

4. By experience, they learned that this was the quickest way to restore a member who had been injured or temporarily paralyzed or put out of commission by

a blow or fall. In a future section of this volume we study the action of the nervous system, and we can then understand why this method produces quick and positive results.

5. A very crude method of spinal adjustment has also been practiced for some time—for the relief of sickness, and with great success in many cases—in America among some of the emigrants from Northern European countries.

6. The author of this work at one time had a patient who was receiving spinal adjustment for lumbago who told of the following incident:

"About twenty years ago I had a Bohemian renter on my farm in Minnesota. One day, when I visited him, we were talking about sickness, doctors, and medicine. He told me he seldom ever called a doctor, nor did he use any medicine; and he proceeded to show how, when he was sick, he would lay prone upon the floor, while his wife would remove her shoes from her feet and walk along his spine." In this way she would relieve his pain and cramping and the fever, he claimed, by walking along his spine from the lumbar to the cervical region.

In her treatment, one foot would be placed on either side of the spinous processes and the application of force or weight would be applied to the transverse processes.

This procedure, no doubt, in a crude way overcame ligamentous contractions, which would approximate vertebræ and narrow the intervertebral foramina, and by this they overcame interference with the nerve supply to the different organs of the body.

These people, we are sure, were not familiar with the methods of giving thrusts and other methods of treatment of the spinal column as were used by Napravit, who probably, as far as we find any history, was the originator of this method of treatment.

Most of the world's greatest discoveries and many of

nature's great secrets have been brought to light by accident or by chance. The true secret of curing disease was discovered in this way and by people without previous education in therapeutic methods.

7. Dr. D. Chaliss Faust's recent trip to Bohemia, the fatherland of Naprapathy, brought back this most interesting bit of history:

Among the Bohemians many were obliged to carry heavy loads on their heads and shoulders or do heavy lifting. Sprained backs were common. When such occurred, the patient would lie face downward on a couch, and the doctor or operator would place his hands over the injured and sprained part of the back. But instead of giving a rubbing treatment, this Bohemian practitioner would deliver a short, quick thrust upon the bones themselves. The click (such as you hear and feel when you click your knuckle-joints) which followed this thrust always brought a most wonderful sense of relief. So effective and certain was this "thrust treatment" that a rubbing treatment was considered very inferior in comparison. So this, then, is the way in which the adjusting treatment started.

But as time went on it was noted that other diseases, with which the patient was suffering, were yielding along with the strained back.

Thus was a true secret of curing disease of the vital organs brought to light, and no discovery, none excepted, is doing more to bring about a complete revolution in the healing art than is this one.

Bohemia is a wonderful country, abounding in many interesting and historical objects, but the most interesting of all to me was the old historic man under whom I studied, Napravit. I had heard much of the old fellow during my two years' residence in Cedar Rapids, Iowa, amongst the Bohemians, learning what I could of the history of Napravit, and every good thing I heard of him

was true. He was called the "Lipony Doctor," and it was said that people came to him from miles around and were healed of many troubles.

When I told him his fame had reached as far as America, and that I had traveled from across the water to study under him, he was much pleased, but took it as a matter of course.

The doctor's name is Pan Jos Vejooda, and he is a direct descendant of the original Napravit physician. He used to keep books for his father and grandfather, and he showed me numerous testimonials dating as far back as the year 1840.

The author believes that this matter is worthy of a thorough investigation by the medical profession, because of the remarkable effects claimed to be obtained by the administration of spinal adjustment.

Many adjusters, with moderate training and little experience, who are now using this method, claim that they are very successful in the removal of impingement or interference with nerves and in the restoration of their normal nutrient supply, thus restoring to them their normal excitability and their freedom to transfer impulse, which they claim restores normal function in previously diseased parts of the body.

BEGINNING OF SPINAL ADJUSTMENT IN AMERICA.

Besides the instances cited above, we have from many sources learned of many different crude methods of spinal treatment in many places in America before it was ever introduced as a school of practice.

There were some methods tending to adjust spinal vertebræ introduced by A. T. Still into a system known as Osteopathy. To-day we find that the osteopaths in many places are beginning to learn and to use the specific

thrust and some of the specific methods of a later school of Chiropractic Spondylotherapy.

The first school established that used the spinal thrust exclusively as a system for the treatment of all ailments, both acute and chronic, was started by D. D. Palmer, who obtained his first ideas of spinal lesions from an osteopath by the name of Struthers. The spinal thrust we understand he obtained from a Bohemian. Palmer, however, established the first school known as Chiropractic, being so named by its founder and to him properly belongs the honor, if such be due, of founding a new school of practice. We find no evidence whatever that he was a discoverer, but find facts to the contrary. Palmer being an uneducated man it has fallen to the hands of others to develop this science.

Because of the gross errors taught in this original school both by the founder and his successor, many have prejudged and condemned this science. Many have felt that no important truth could be mixed with so many gross errors.

Some of the medical profession and others of the better educated class of people have felt that because spinal adjustment was first introduced by a man who was wholly uneducated in therapeutic lines, he could not have known of any method of much consequence or importance as a therapeutic auxiliary; but this does not, by any means, follow.

Hydrotherapy.—Was established as a cure for disease by Priestnitz, an uneducated peasant of Northern Europe. The "water cure" has accomplished good in the alleviation of disease, both acute and chronic.

Electrotherapeutics.—Was first recommended and used for the relief of disease by men outside of the medical profession. It was considered a fraud and by the ignorant was thought to be the work of the devil, and it was slow

in being accepted by the medical profession, as too much was claimed for it.

Both hydrotherapy and electrotherapy, being originated and championed by men outside of the medical profession and by men uneducated in therapeutic lines, were therefore slow in being received.

The false and extravagant claims made concerning their efficacy caused these remedial agents to be branded as "fakes" and their reception retarded. After the medical men became convinced that there was merit in hydrotherapy and electrotherapy they have adopted these methods as adjuncts to their therapeutic measures, and by their superior education and intelligence have greatly developed these agencies of treatment, making them much more effective and meritorious.

Looking forward, we feel sure that when the medical world know the value and potency of this new method of treatment herein described, they will be glad to use it successfully in so many cases where no other method of treatment will effect a cure, and that they will appreciate the one who has been instrumental in bringing this knowledge to their minds.

We fully appreciate that ignorance and superstition have shrouded the meritorious effects of this most potent and wonderful method of treatment, and also prevented its progress and acceptation by the medical profession.

We are also hopeful that the present explanation of the philosophy of this treatment will be a continuation of developments begun by the author, and that this work will be a real blessing to our profession and their clients, who will be benefited by the use of the rational methods herein introduced and described.

SPINAL TREATMENT

PART ONE.

NERVOUS SYSTEM AND FUNCTION.

CHAPTER I.

ANATOMY OF THE NERVOUS SYSTEM.

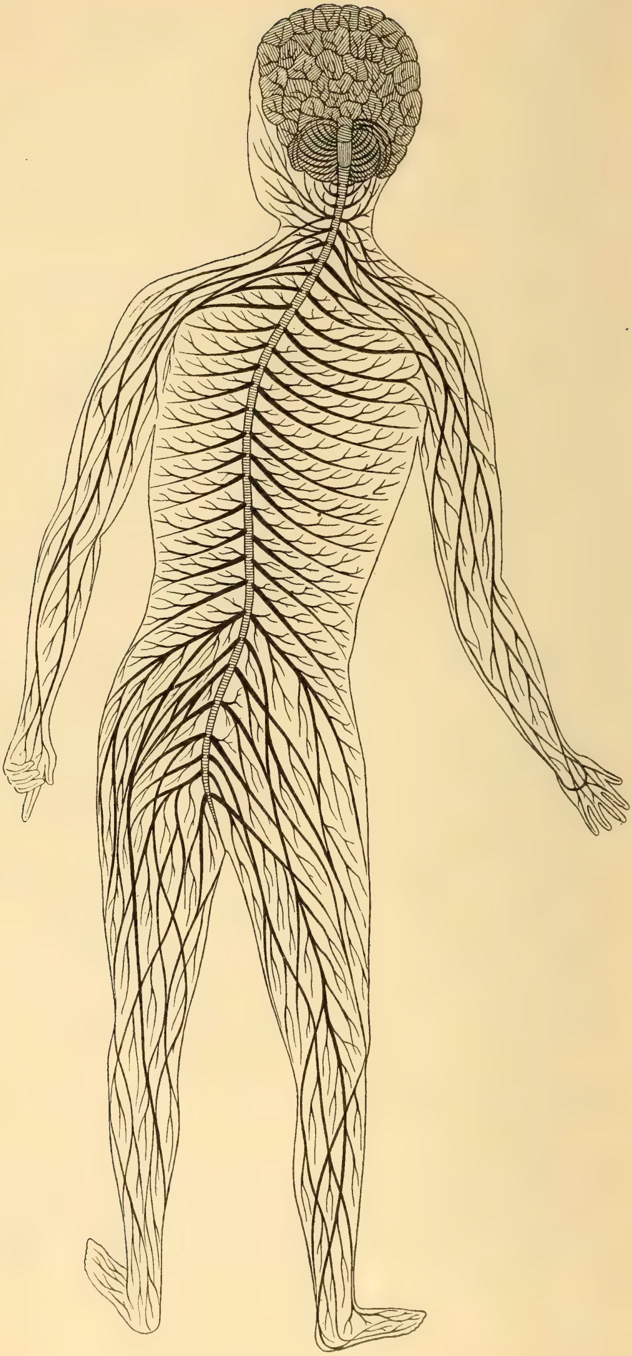
DISEASE is essentially the phenomenon of deranged function, and all structural alterations are the resulting effects of the deranged function, except in cases of traumatism.

Since all functional activity is the result of nerve impulse, the study of deranged function is but an investigation of the manifestation of disease, and the study of histological lesions is but a study of the effects of abnormal function.

Our first and most important consideration in the study of disease, is a study of the nervous system, more especially from the standpoint of nerve function, but in our investigation of the nervous system, we wish to study the following enumeration of the phases of nerve phenomena and anatomy:

1. A study of the anatomy of the nervous system.
2. A study of the nature of nerve function.
3. Manner of interference with nerve function.
4. Results of interference with nerve function.
5. The relief of interference with nerve function.
6. A study of the distribution and ramification of nerves.
7. Methods of diagnosis from spinal lesions affecting nerves.

We first give our special attention to the general anatomy of both the central and peripheral portions of the nervous system, throughout all portions of the human body.



The student may desire to study only the functional activity of the nervous system; or, he may wish to study especially the structural arrangement thereof, but the study of these two phases of this subject go most successfully hand in hand.

As a basis for the study of the functions of the nervous system, we find it necessary to have a comprehensive knowledge of the structural formation thereof.

In the study of the anatomy of man as a whole, we consider several phases of the subject. Some of the more essential divisions of anatomical study are as follows:

1. Myology, the anatomy of the muscles.
2. Osteology, the anatomy of the bones.
3. Syndesmology, the anatomy of the joints.
4. Splanchnology, the anatomy of the viscera.
5. Adenology, the anatomy of the glandular organs.
6. Angiology, the anatomy of the blood vessels and lymphatics.
7. Neurology, the anatomy and physiology of the nervous system.

In the diagnosis and treatment of pathological lesions, we invite special attention to the last anatomical division, namely: Neurology. The first consideration, however, in the study of Neurology, is securing a knowledge of the anatomy of the nervous system as a basis for the study of its functional action.

The nervous system ramifies all parts of the body. There is not an organ, nor a component cell in an organ or part of the body, that is not supplied by terminal nerve filaments either directly or indirectly. The peripheral afferent nerve endings, together with the terminal fibers of the efferent nerves, are abundant in all parts of the human body.

The afferent nerve endings are so abundant in the surface of the body, that the point of a fine cambric needle cannot enter the integument without mechanically

injuring a nerve filament, which is evidenced by the fact that we always feel an excitation, or more or less painful sensation as a result of the prick of a needle, provided the excitability of the nerve endings is normal.

If all the tissues of the body were dissolved away except the nervous system, we would have in all the peripheral portions of the body a complete outline of the human form represented by the terminal peripheral branches of the nerve fibers.

Since the first knowledge necessary to be obtained concerning the subject of the nervous system is that of its anatomy, we will first consider in a brief way the central formation, together with the distribution and ramification of the peripheral portions of both the cerebro-spinal and sympathetic divisions.

We realize that the anatomy of the nervous system as given in the ordinary text-book, is more or less complex and obscure. In order to render this subject more comprehensive, we will present it from the standpoint of its fundamental formation, and gradually work out the more minute ramifications, as we find this is the most successful way of presenting this subject both in lectures and class instruction.

We recognize the primary anatomical divisions of the nervous system, as follows:

1. The cerebro-spinal division.
2. The sympathetic division.

These two parts or divisions of the nervous system are not, and should not be considered as two nervous systems, but merely subdivisions of one great nervous system.

THE CEREBRO-SPINAL DIVISION.

WE will first consider briefly the cerebro-spinal division of the nervous system, as to its gross anatomy, but will leave the ramification or distribution of nerves for subsequent portions of this work.

The cerebro-spinal system, through its terminal branches, ramifies all portions of the body, and is composed of the following divisions which are easy to grasp and understand:

I. Brain, or encephalon.
II. The spinal cord extension.
III. Twelve pairs of cranial nerves.
IV. Thirty-one pairs of spinal nerves.
V. The numerous nerve plexuses.
VI. The branches of ramification.
VII. The branches of communication.

I. The Brain.—The brain is the central portion of the nervous system, and is by far the largest accumulation of nerve tissue that is found in one location, anywhere in the body.

The brain is the seat or center of life and intelligence, and may be considered as the great dynamo that generates and furnishes the vital force and consequent activity of all the peripheral portions of the nervous system, and vitality of the tissues which are supplied thereby.

II. Spinal Cord.—The spinal cord is the primary division of the nervous system, being the first portion that is developed in the embryological formation of the fetus.

III. Cranial Nerves.—Twelve pairs of cranial nerves are given off from the brain and medulla oblongata. The nerves given off from the brain pass out of the cranial cavity through bony foramina, and are distributed directly to the organs they supply in most cases. None of the cranial nerves are subject to any direct interference by lesions of the spinal column. Spinal lesions only affect cranial nerves by interfering with spinal nerves supplying communicating branches to them.

The cranial nerves are named according to their anatomical formation, and according to their function

and the organs they supply, and for this reason their names are easily remembered when they are associated with the organ controlled by them or with the organ which they supply.

We give the following easy method of remembering the names of the cranial nerves. This plan consists of remembering a sentence formed of twelve words; and the first letter of each word in this sentence is the same as the first letter of the name of the corresponding spinal nerve.

The sentence, which is easy to remember, is as follows: "On old Monadnock's pointed top a Finn and German picked some hops." The first letter of the first word of this sentence is "O," and so the first letter of the name of the first pair of nerves is "O." The second in this way is the same as the first, and so on. We arrange this matter as follows, for your convenience:

I. On .... Olfactory nerves.
II. Old .... Optic nerves.
III. Monadnock's .... Motor oculi nerves.
IV. Pointed .... Pathetic nerves.
V. Top .... Trifacial nerves.
VI. A .... Abducens nerves.
VII. Finn .... Facial nerves.
VIII. And .... Auditory or acoustic.
IX. German .... Glosso-pharyngeal.
X. Picked .... Pneumogastric.
XI. Some .... Spinal accessory.
XII. Hops .... Hypoglossal.

IV. Spinal Nerves.—The spinal nerves are not named as are the cranial nerves, but while they are not named individually, they are divided into regions, and the regional divisions are named as follows:

1. Cervical.
2. Thoracic.
3. Lumbar.

4. Sacral.
5. Coccygeal.

There are thirty-one pairs of spinal nerves, with the following numbers in the different regions:

8 pairs of Cervical nerves.
12 pairs of Thoracic nerves.
5 pairs of Lumbar nerves.
5 pairs of Sacral nerves.
1 pair of Coccygeal nerves.

V. Nerve Plexuses.—The cranial and spinal nerves give off branches, which, in their distribution, communicate with each other, and in this way numerous plexuses are formed. This plexus formation constitutes the fifth anatomical division of the cerebro-spinal division of the nervous system. The formation of the plexuses is more conspicuous in some regions than in others. For example:

In the cervical region we have the formation of both the cervical plexuses and the brachial plexuses. However, the brachial include branches from the upper two or three pair of thoracic nerves.

In the lumbar and sacral regions the spinal nerves enter into the formation of plexuses of considerable importance, from which are given off the nerves which supply the lower extremities.

VI. and VII. The Branches of Ramification and Communication.—The terminal branches of distribution that ramify the peripheral tissues of the body, and the branches of communication which connect with certain portions of the abdominal brain, constitute what is known as the branches of ramification and branches of communication, and these branches constitute the sixth and seventh elementary division of the structural formation of the cerebro-spinal division of the nervous system.

THE SYMPATHETIC DIVISION.

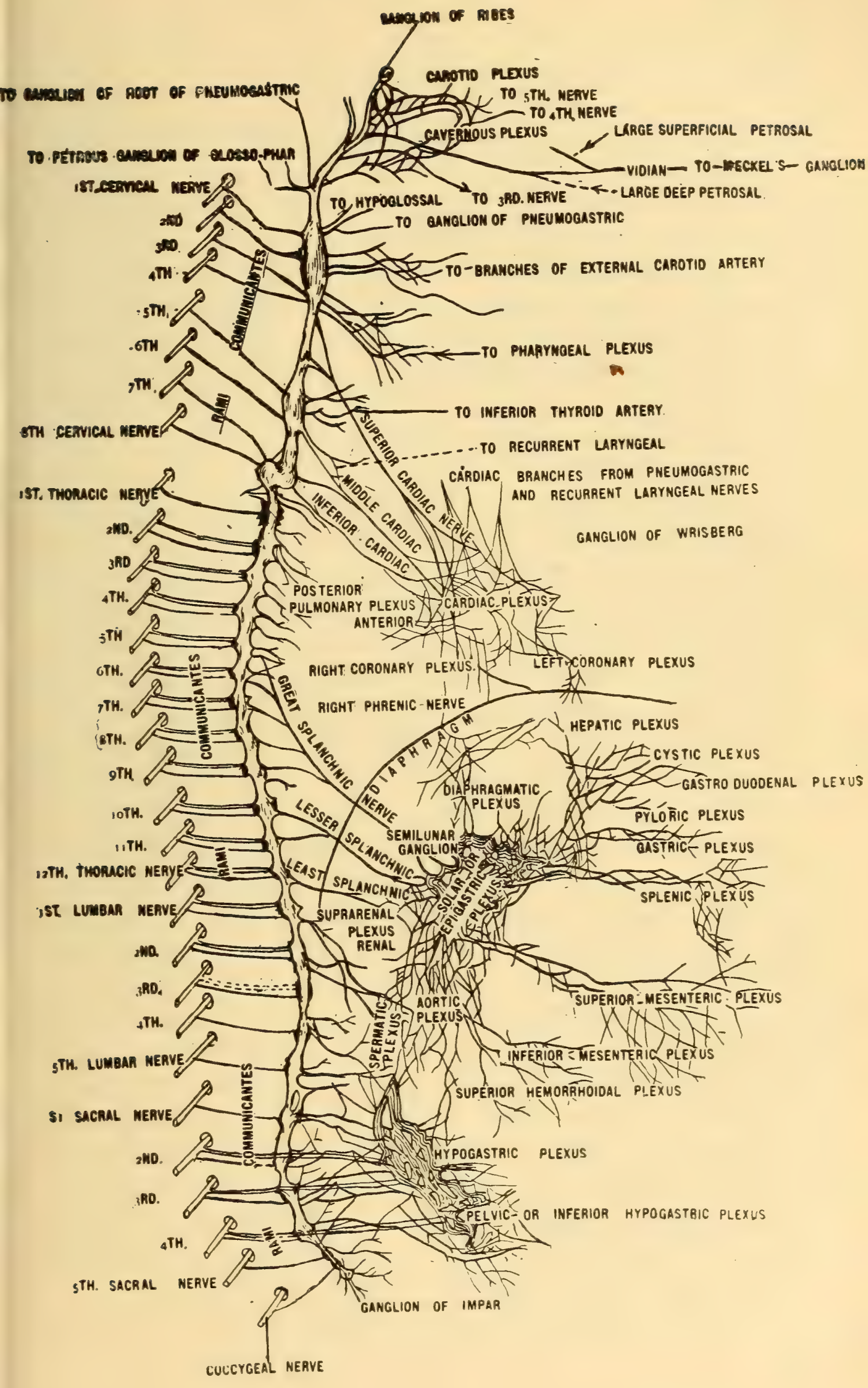
The sympathetic nervous system, sometimes called the abdominal brain, or gangliated portion of the nervous system, is probably less understood generally as to its anatomy and physiology than is the cerebro-spinal system.

Even the name of this division of the nervous system has been called into question. While anatomists agree as to the name of the sympathetic portion of the nervous system, others object to its established name. There is no doubt that this division of the nervous system was so called primarily because of an erroneous belief concerning the functions of the nervous system.

Formerly the practitioners of the healing art, before the days of our modern and more intelligent physicians, believed that there was an intelligence that was responsible for the cellular functional activity of the organs and parts of the body, and that all the action of the vital processes was a result of an intelligence which was the motive power for all activity, and with this view as a basis upon which to form their conclusions, all reflex neuroses such as reflex pain, and also the phenomena of metastasis, were explained on the ground of a sympathetic intelligence.

Recent physiological demonstrations, however, have overthrown the view that an intelligence passes over the nerves to wholly control the vital activity, but the adherents of the former theories are unlearned as to the demonstrations that have been made more recently and which have set the medical and intelligent world straight concerning this matter. Those who hold to the view that nerve action is the phenomena of intelligence should favor the name sympathetic system.

We believe, however, that no more appropriate name


GANGLION OF RIBES
CAROTID PLEXUS
TO GANGLION OF ROOT OF PNEUMOGASTRIC
TO 5TH. NERVE
TO 4TH. NERVE
CAVERNOUS PLEXUS
LARGE SUPERFICIAL PETROSAL
TO PETROUS GANGLION OF GLOSSO-PHAR
VIDIAN — TO MECKEL'S GANGLION
1ST. CERVICAL NERVE
TO HYPOGLOSSAL
TO 3RD. NERVE
LARGE DEEP PETROSAL.
2ND
3RD
TO GANGLION OF PNEUMOGASTRIC
4TH
TO BRANCHES OF EXTERNAL CAROTID ARTERY
COMMUNICANTES
5TH
6TH
TO PHARYNGEAL PLEXUS
7TH
RAMI
TO INFERIOR THYROID ARTERY
8TH CERVICAL NERVE
TO RECURRENT LARYNGEAL
SUPERIOR CARDIAC NERVE
CARDIAC BRANCHES FROM PNEUMOGASTRIC
AND RECURRENT LARYNGEAL NERVES
1ST. THORACIC NERVE
MIDDLE CARDIAC
INFERIOR CARDIAC
2ND.
GANGLION OF WRISBERG
3RD
POSTERIOR
4TH.
PULMONARY PLEXUS
CARDIAC PLEXUS
ANTERIOR
5TH
6TH.
RIGHT CORONARY PLEXUS.
LEFT CORONARY PLEXUS
COMMUNICANTES
7TH.
GREAT SPLANCHNIC
RIGHT PHRENIC NERVE
8TH.
HEPATIC PLEXUS
DIAPHRAGM
9TH
CYSTIC PLEXUS
GASTRO DUODENAL PLEXUS
10TH.
DIAPHRAGMATIC PLEXUS
NERVE
LESSER SPLANCHNIC
PYLORIC PLEXUS
11TH.
SEMILUNAR GANGLION
GASTRIC PLEXUS
12TH. THORACIC NERVE
RAMI
LEAST SPLANCHNIC
SOLAR OR EPIGASTRIC PLEXUS
SPLENIC PLEXUS
1ST. LUMBAR NERVE
SUPRARENAL PLEXUS
RENAL
2ND.
3RD.
SUPERIOR MESENTERIC PLEXUS
AORTIC PLEXUS
4TH.
SPERMATIC PLEXUS
5TH. LUMBAR NERVE
INFERIOR MESENTERIC PLEXUS
COMMUNICANTES
SUPERIOR HEMORRHOIDAL PLEXUS
S1 SACRAL NERVE
2ND.
HYPOGASTRIC PLEXUS
3RD.
PELVIC OR INFERIOR HYPOGASTRIC PLEXUS
4TH.
RAMI
5TH. SACRAL NERVE
GANGLION OF IMPAR
COCCYGEAL NERVE

could be had for this division of the nervous system, and for several reasons:

As follows, it is this portion of the nervous system which seems to regulate the automatic action of the viscera, the sensations of hunger and thirst, and the processes of metabolism throughout the system, and from this consideration, "sympathetic system" is a very appropriate name for this division of the nervous system.

We quote in this connection the recorded history concerning the discovery and early opinions of the sympathetic system.

It is claimed that the sympathetic was known to the Hippocratic school. Hippocrates (460–370 B. C.), who practiced medicine at Athens, Greece, doubtless saw the sympathetic many times, at least in animals, but did not interpret its functions. Yet he was one of the first to cast aside tradition, which, by the way, still lingers, and to practice medicine on a basis of inductive reasoning, just as a carpenter takes careful measurements before building a house, or as a physicist studies astronomy.

Erasistratus (340–280 B. C.) believed that all nerves arise from the brain and cord, but doubtless did not recognize the sympathetic nerves as such. It appears, however, that he separated nerves into those of motion and sensation. He studied particularly the shape and structure of the brain.

Herophilus (300 B. C.), it appears, dissected more than all his predecessors, both in man and animals. He was the first to distinguish nerves from tendons, which Aristotle confounded. Herophilus gave the duodenum its name because it is twelve inches or finger breadths in length. He, like Erasistratus, distinguished nerves of motion from those of sensation, and added a careful study of the brain. We all remember his "Torcular Herophili," or wine-press.

Aristotle (384 B. C.), who widely dissected animals

while instructing Alexander, the son of King Philip, no doubt saw the sympathetic system frequently, yet did not interpret its significance, for he confounded tendons and nerves.

B. Eustachius, an Italian anatomist, who died in 1574, considered that the sympathetic nerves originated from the abducens or sixth cranial nerve. It was not until the name of Thomas Willis (1622–1675), an English physician, appeared in anatomical records, that the proper significance of the sympathetic nerves was recognized. Willis looked on the sympathetic system of nerves as an appendage of the cerebro-spinal system and represented them as growing from the cerebro-spinal nerves. Many neurologists hold the same opinion to-day as did the able Willis two hundred and fifty years ago. He looked upon the sympathetic nerves as a kind of diverticula for the animal spirits received from the brain. In 1660, while Sedleian professor of philosophy at Oxford, he described the chief ganglia.

René Descartes (1569–1650) was one of the first to describe reflex movements from ganglia.

R. Vieussens (1641–1716), a French anatomist, wrote a work entitled "Neurograph" in 1684, in which he adopted the views of Willis, that the ganglionic nerves were appendages of the cerebro-spinal system.

Vieussens wrote of the ganglia of the solar plexus.

Prochaska described the reflex channels.

Duverney (1643–1730) discovered the ciliary ganglia.

J. M. Lancisus (1654–1720), an Italian anatomist, wrote a monograph on the sympathetic nerves, agreeing with the keen Willis as regards structure. His monograph was entitled "Opera Omnia." Lancisus looked upon the sympathetic nerves as a kind of forcing pump adapted to propel the animal spirits along the nerves.

The senior Johann Friedrich Meckel (1714–1774), in his "Memories de Berlin," 1745, held views on the sub-

ject of the sympathetic nerves similar to those of Willis, as did also Johann Gotfried Zinn (1727–1759), in a publication in 1753.

J. B. Winslow (1669–1760), a Dane, professor of anatomy in Paris, insisted in his writings on the independence of the sympathetic nerves. Since that time writers have wavered between the opinions of Winslow (independence) and Willis (dependence) in regard to the sympathetic nervous system. Yet up to one hundred years ago actual physiologic and experimental data were quite limited. Bichat, who widely influenced the anatomic world, vigorously proclaimed the independence of the sympathetic ganglia.

Hoare wrote a publication in 1772 on the sympathetic system, entitled "De Ganglia Nervorum."

Antoine Scarpa (1752–1832), the Italian anatomist of "Scarpa's Triangle" fame, wrote an essay on the sympathetic system, entitled "De Nerv. Gangl.," in 1779. This work of course contained the views of previous writers.

Alexander Monro (Monro secundus, 1733–1817), a Scotch anatomist of Edinburgh University, published an essay "On the Structure and Function of the Nervous Ganglia," in 1783. The later writers analyzed more in detail and generalized in a manner superior to that of previous writers, yet all agreed or disagreed with Willis or Winslow.

Johann Friedrich Blumenbach (1752–1840), a German anatomist, in "Institutes of Physiology," published views on the sympathetic nerves in 1786.

Francois Chaussier (1746–1828), a French surgeon and anatomist, wrote an "Exposition" of sympathetic nerves in 1807.

In 1812 Le Gallois wrote "Sur le Principe de la Vie," containing views on the sympathetic nerve.

In 1823 views of the sympathetic nerve appeared in Beclard's "El. d'Anat. Gen."

Georges Cuvier (1769–1832), a famous French naturalist, espoused the doctrine of the independence of the sympathetic nervous system as published in his "Lecons d'Anat. Comp.," 1799.

Xavier Bichat (1771–1802), the master intellect of his day in Paris, professor of anatomy and physiology, the associate and rival of the priestly physician, Pinel, may be heard insisting with his accustomed eloquence upon the independence of the sympathetic nervous system, as noted in his "Sur la Vie et la Mort," 1802. Bichat represented all the ganglia of this system as the particular centers of organic life, that not only were all the ganglia collectively independent, but that each ganglion was independent of every other ganglion, that each nerve proceeding from such a ganglion was in a great measure independent from that ganglion, and even that each point of such a nerve was independent of all the rest and consisted of a distinct focus of nervous influence. Bichat's influence is distinctly traceable through subsequent writings on the sympathetic system.

Wilson Philip wrote "On the Vital Functions," in 1817, analogous to the grand center of animal life. He also held views referring to the sympathetic system.

In Mason Good's work "On the Study of Medicine," in 1825, views are expressed in regard to the sympathetic nervous system.

Writers on the sympathetic system became more numerous in the period subsequent to 1800.

Richerand (Phys. 1804) and Gall (Anat. et Phys. du Syst. Nerv. 1810), adopted tenets concerning the sympathetic nervous system similar to those of Bichat.

Wurtzer in 1817 (De Corp. Hum. Gang.) further inculcated Bichat's, Winslow's, and Cuvier's views.

Broussais, whose name is as indelibly connected with

inflammation of the peritoneum as Bichat's is with establishing the independence of the sympathetic, describes a peculiar kind of sensibility or irritability belonging to the sympathetic nerves with which it immediately endows all organs destined for nutrition, secretion, and the other organic functions, and, by means of its repeated connections with the cerebro-spinal system, all organs of the body.

Brachet, in his "Sur les Fonctions du Syst. Nerv. Gang.," 1823, in an especial manner, distinctly represents the ganglionic system of nerves as the seat of "imperceptible sensation" and as presiding in an especial manner over the several viscera of the body. Byron Robinson, though not acquainted with Richerand's and Bichat's views, worked out the same views from original studies and experiments, but added the idea that the abdominal brain (solar plexus) is the chief organizing center of the abdominal sympathetic.

The preceding views are simply some of the chief landmarks in the progress of the evolutionary development of the knowledge of the sympathetic nerves, in the direction of their function and signification.

The most significant names among the brilliant galaxy of students of the sympathetic nerves are Willis, Bichat, Cuvier, Winslow, and Brachet.

In 1835 articles on the sympathetic nerves began to appear from the pen of James George Davy, of London, England, which study and writing on the sympathetic he continued for about thirty years. In 1858 the same author published a book, "On the Ganglionic Nervous System." The work is composed of 109 pages, is interestingly written, and contains about all the real knowledge of the subject up to that date (1858). Davy claimed that much of his book was original, and doubtless this industrious worker produced many new views in thirty years of labor. Yet Davy, as we view him forty years past,

appears very honest in that he credits the gifted Bichat with so many original views and vast conceptions. The writer can only hope that readers forty years hence will view the present accepted views with similar candor and charity.

The anatomical divisions of the sympathetic system are fairly plainly marked, and may be comprehensively studied under the following divisions:

I. Gangliated cords.
II. The cardiac plexus.
III. Epigastric plexus.
IV. Hypogastric plexus.
V. The terminal plexuses.
VI. The branches of ramification.
VII. The branches of communication.

I. Gangliated Cords.—The two gangliated cords of the sympathetic system are the foundation of this division of the nervous system. They are situated in front of and to the side of the bodies of the vertebræ and in comparatively close relation thereto.

They extend from the base of the brain above to the lower end of the spinal column below. Their upper commissural union is in the ganglion of Ribes above and their lower union is in the ganglion of Impar or coccygeal ganglion below.

These cords consist of a series of ganglia connected by commissural fibers of both the cerebro-spinal and sympathetic rami communicantes.

The ganglia of the gangliated cord are as follows:

Three in the cervical region.
Twelve in the thoracic region.
Four to five in lumbar region.
Two to eight in the sacral region.

The cervical region of the gangliated cords contains ganglia on each side as follows:

1. Superior cervical ganglion.

2. The middle cervical ganglion.
3. The inferior cervical ganglion.

II. Cardiac Plexus.—The cardiac plexus is situated in the thoracic cavity and supplies the viscera that are contained therein.

This plexus is made up of cranial, cervical, and thoracic nerve branches and of gray rami of the ganglia of the sympathetic cords.

This great plexus does not supply the viscera of the thoracic cavity by direct ramification but by giving off the terminal ganglia which directly supply the different organs of this cavity.

III. Solar Plexus.—The solar or epigastric plexus supplies the organs or viscera of the abdominal cavity and is made up of branches from different regions of the spinal column and from branches of the gangliated cords.

This great plexus is made up principally of fibers as follows:

1. Branches from the cranial nerves.
2. Branches from the cervical nerves.
3. Branches from the lower thoracic nerves.
4. Branches from the lower thoracic ganglia.

The solar plexus also gives off terminal ganglia which supply the viscera of the abdominal cavity, and they are either situated in close relation to the organ they supply or within the muscular wall of some of them, as in the case of the stomach and the more muscular viscera.

IV. Hypogastric Plexus.—The hypogastric or pelvic plexus is situated in the pelvic cavity and supplies the organs of generation and other organs of the pelvic cavity.

This ganglion is made up of the terminal branches of the pneumogastric nerves, branches from the lower thoracic nerves, branches from the lumbar and sacral nerves, and branches from the gangliated cords of the sympathetic system.

This plexus supplies the pelvic viscera by giving off terminal ganglia. The terminal ganglia also receive branches from the spinal nerves. The terminal ganglia are situated in close proximity to the organs they supply or within the organ they supply, as in the case of the uterus.

V. Terminal Ganglia.—The terminal ganglia are the peripheral ganglia referred to above and that portion of the sympathetic system that most directly supplies the different viscera of the cavities of the trunk.

When they are situated within the organ they supply, they will for a time maintain the action of the organ after it is separated from all other nerve connection, and this fact proves that the terminal sympathetic ganglionic cells possess the power of functioning for a time independent of the other portion of the nervous system, and incidentally disproves the theory of innate intelligence controlling all functional activity.

VI. Branches of Ramification.—The branches of ramification are the terminal peripheral rami supplying different portions of the body and are given off from the terminal and other ganglia and from nerves.

VII. Branches of Communication.—The branches of communication are those branches that connect the different ganglia of the sympathetic system and connect the ganglia with different nerves of the same regions, or, in other words, the communicating branches are those that connect the ganglia with ganglia, and ganglia with nerves, and nerves with nerves.

CHAPTER II.

CONNECTIONS BETWEEN THE CEREBRO-SPINAL AND SYMPATHETIC DIVISIONS OF THE NERVOUS SYSTEM.

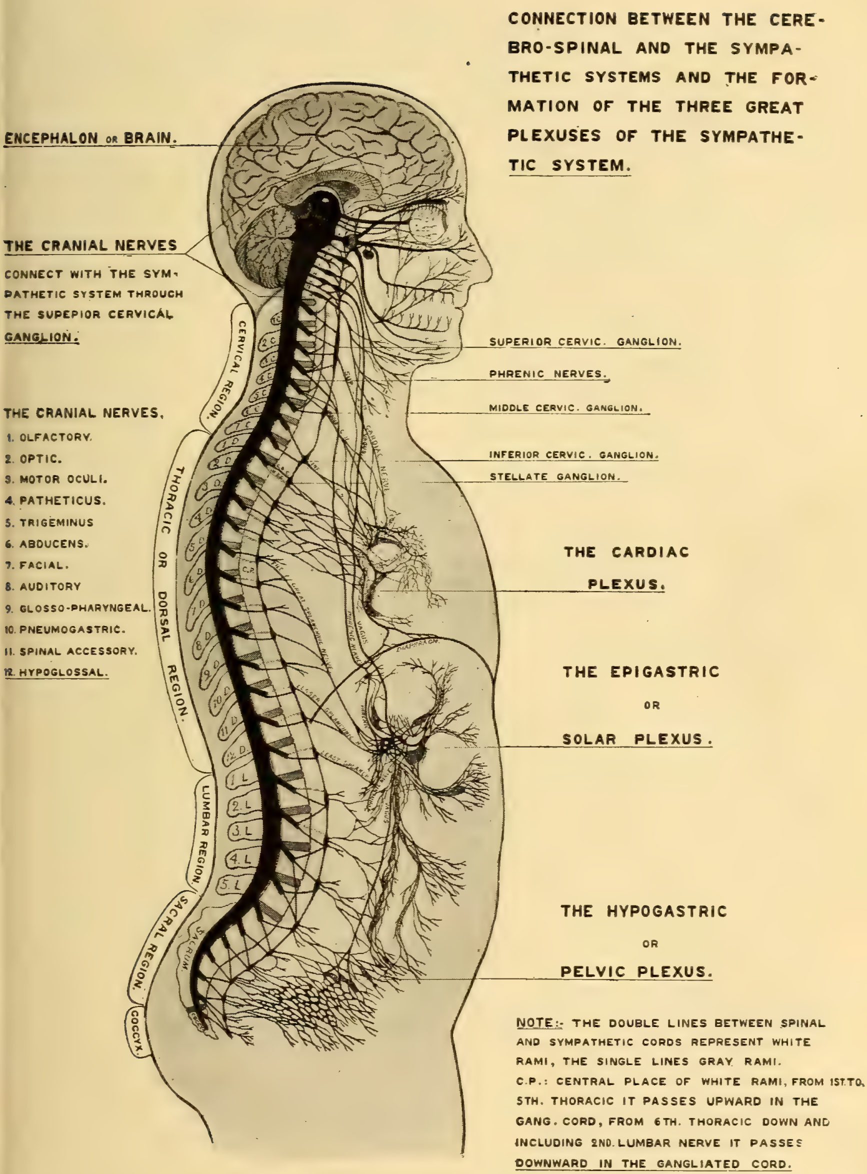
FOLLOWING our brief description of the gross component parts of the two primary divisions of the nervous system, we will next briefly consider the connections existing between them, and their relation one to another. This is a very interesting study, and a subject that has been studied to a considerable extent, but probably not so extensively investigated as we would like to see.

1. The cerebro-spinal division of the nervous system and its branches of distribution ramifies all parts, both central and peripheral, of the human body.

2. The branches of communication and distribution of the sympathetic division of the nervous system ramify every portion of the human anatomy, both central and peripheral.

In this chapter our special investigation will be concerning what is the connection existing between these two divisions of the nervous system, and their relation in their ramification of the body.

The cerebro-spinal system is the fundamental portion of the nervous system from the standpoint of functional action, if not from its anatomical conformation. There is no one part of either division of the nervous system that is independent of all other portions of the nervous system. While the brain is the central organ of the nervous system, it cannot survive independent of the other portions of the nervous system. The spinal cord cannot retain its power of action or vitality except when connected normally with the brain.



This illustration made after the direction of the author, especially for this work.

The abdominal brain, or sympathetic system, is also wholly dependent upon its connection with the cerebro-spinal system for its vitality and power of action. To study the connections existing between the cerebro-spinal and sympathetic divisions of the nervous system, is somewhat difficult, and I know of no laboratories in this country that are equipped for proper and extensive investigations along this line, but from different sources in our anatomical studies we have been able to gain considerable information which we are glad to enumerate in this connection.

Color Demarcations.—

The color of the nerve centers or nerve cells is gray in both the cerebro-spinal and sympathetic divisions of the nervous system, there is a marked difference in the color of the fibers of the communicating and ramifying branches of the two divisions of the nervous system that is very characteristic and helpful in tracing their distribution.

All the fibers of the cerebro-spinal system are white, while the fibers of the sympathetic system are gray. The difference in color enables us to distinguish and trace the nerve fibers of these two divisions of the nervous system as they pass from one division to another. In harmony with this distinction in color, anatomists term the communicating branches coming from the cerebro-spinal system, "white rami communicantes," whereas connecting branches from the sympathetic system are termed "gray rami communicantes."

An investigation of the connections existing between these two divisions of the nervous system solves a great many problems for us as to the source of the nerve supply affecting different organs and viscera. In this way we are enabled to understand why and how interference with cervical and thoracic spinal nerves will alter and decrease

the function of cranial organs and the organs of special sense, as the eyes, ears, and olfactory organs.

White Rami to Sympathetic.—

We will first consider the white rami communicantes given off by the cerebro-spinal system, and their connection with the sympathetic system.

We have in all twelve pairs of cranial nerves, and thirty-one pairs of spinal nerves that give off white rami communicantes that connect with some portion of the sympathetic system, but a limited number of the spinal nerves, however, and none of the cranial nerves, nor of the sacro-spinal or cervico-spinal nerves, send white rami communicantes into the fundamental portions of the sympathetic system, namely: The two gangliated cords.

We find a direct connection between all the thoracic spinal nerves and the upper two pair of the lumbar nerves and the gangliated cords, as follows:

From each pair of spinal nerves, from the first dorsal down to and including the second lumbar pair, we have white rami communicantes given off by each pair of spinal nerves, passing directly to the corresponding ganglia of the two gangliated cords of the sympathetic.

The second pair of thoracic nerves send white rami communicantes to the second thoracic ganglia of the gangliated cords. The third to the third, the fourth to the fourth, and so on in this way down to and including the second lumbar.

The first thoracic pair of spinal nerves sometimes does and sometimes does not send white rami communicantes into the stellate pair of ganglia of the gangliated cords. Above the first or second thoracic pair of nerves, and below the second lumbar, we find a different distribution of the white rami communicantes.

The white rami communicantes which are given off by the cerebro-spinal division of the nervous system in the cranial and cervical regions, pass directly into the

terminal ganglia of the sympathetic system without joining the gangliated cords.

This is also true of the lumbar nerves below the second pair, as they send their white rami, not into the gangliated cords, but directly into the terminal ganglia of the sympathetic of this region of the body.

The sacro-spinal nerves also send their communicating branches into the terminal ganglia of the sympathetic direct, but do not send white rami communicantes into the gangliated cords.

Some of the terminal ganglia that receive white rami communicantes from the cranial and cervical spinal nerves in the cranial region, we enumerate as follows:

Spiral ganglia.	Carotid ganglia.
Meckel's ganglia.	Bidder's ganglia.
Tympanic ganglia.	Cephalic ganglia.
Temporal ganglia.	Pharyngeal ganglia.
Vestibular ganglia.	Geniculate ganglia.
Ophthalmic ganglia.	Inter-optic ganglia.
Reticulate ganglia.	Infra-maxillary ganglia.
Submaxillary ganglia.	Gasserian or semi-lunar.

The principal terminal ganglia of the sympathetic which receive white rami communicantes from the lumbar and sacral nerves, are as follows:

Vesical plexus.
Vaginal plexus.
Uterine plexus.
Prostatic plexus.
Plexus Cavernosus.
Plexus Differential.
Plexus Hemorrhoidal.

The terminal ganglia of the sympathetic system which are enumerated above, are the terminal ganglia which are supplied by the white rami communicantes of the cranial and spinal nerves above and below those which enter the two gangliated cords. The first enumeration

embraces the principal ganglia of the sympathetic, which are supplied with white rami received from the cervical and cranial nerves, while the latter enumeration embraces the terminal ganglia of the sympathetic and the pelvic region which receive the white rami communicantes from the sacro-spinal and lumbo-spinal nerves below the second lumbar, which do not send white rami into the gangliated cords.

Two Streams of White Rami.—We would call special attention to one more point concerning the white rami communicantes of the thoracic and upper lumbar regions that join the gangliated cords of the sympathetic. We notice when the white rami communicantes join the ganglia of the sympathetic cords, that portions of the fibers behave differently:

One portion of the white rami joining the sympathetic ganglion passes unchanged directly through the ganglion they join, to a terminal ganglion of the sympathetic system.

Another portion of the white rami communicantes of the spinal nerve, when it joins the ganglion of the gangliated cord of the sympathetic, arborizes around the cells of the ganglion which it joins, and impulses passing over these white rami are exchanged to and carried on by means of gray rami to final distribution.

Still other fibers of the white rami join the gangliated cord of the sympathetic, and pass unchanged by way of the commissural cord to other ganglia of the cord above or below the one which they join. We find that the white rami are distributed in this way by two streams:

1. Fibers of the white rami of the upper thoracic nerves pass upward into the upper portion of the gangliated cords, while those of the lower thoracic region, joining the lower portion of the gangliated cords, pass downward.

2. It is the upper five or six pair of thoracic spinal

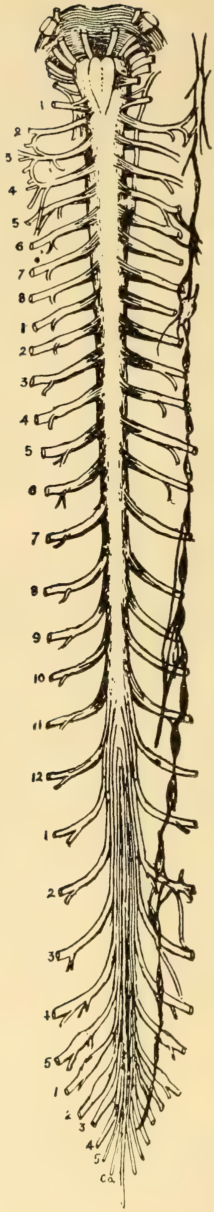


Illustration showing the spinal cord and a gangliated cord, and connections. (Courtesy M. E. Clark.)

nerves that give off white rami which send part of their fibers upward, while the white rami from the lower spinal nerves, from the sixth pair down, send their fibers, which join the gangliated cords, downward.

Thus we have the formation of the two streams of the white rami communicantes with the dividing point between them at the sixth segment of the spinal cord. This is one of the anatomical marks which locate what we term central place of the nervous system, which is the sixth segment of the thoracic region.

The upward stream of the white rami communicantes, or the remainder of their fibers arising from the upper thoracic region and passing up the commissural cord of the sympathetic, terminate in the superior cervical ganglia of the sympathetic, and it is by means of this upward stream of these white rami communicantes in the gangliated cord of the sympathetic, that the upper portions of the gangliated cords are supplied.

The downward stream of white rami communicantes from the lower thoracic region and upper lumbar segments which join the corresponding portion of the gangliated cords, pass downward, and thus the lower portions of the gangliated cords of the sympathetic are supplied by white rami communicantes.

This at first would seem to be a peculiar arrangement and distribution of the white rami communicantes, but a study of the embryological development of the fetus seems to offer some explanation of the ultimate arrangement of the nerve supply of the more distal organs from the central place or division of the spinal cord.

The spinal cord is formed first, and the organs primarily are formed not in the position and relation they are found after perfect development. As development progresses, the organs of the lower portion of the trunk that are starting to develop near central portions of the spinal region, grow downward, while the viscera of the

upper portion of the body pass and grow upward. The organs of the pelvic cavity are primarily started in their development higher up than they are located after development is completed. This fact seems to correspond with the final arrangement in which the downward stream of white rami communicantes from the thoracic regions pass or extend downward to supply the organs which have passed down during development.

We have a similar peculiarity of the development of the brain and cephalic organs, which tallies in a measure with the arrangement of the upward stream of white rami from the upper thoracic region. The brain primarily begins to develop as small terminal growths on the upper end of the spinal cord. At first these protuberances are thirteen in number, but as development progresses, we find that the thirteen protuberances unite into three divisions, namely: The front brain, the mid brain, and the posterior brain.

There is also a development of the different organs and parts of the head in the same way, and this fact of development corresponds with the upward stream of white rami, which we have now learned influences the brain and cephalic organs. This phase of our subject will be brought out more fully when we take up the consideration of the nerve supply to the different organs and parts of the body.

Gray Rami to Cerebro-Spinal Nerves.—

We now turn our attention to the reverse connection, namely: The connection of the sympathetic system with the cerebro-spinal by means of gray rami communicantes. This connection is more simple and more easily comprehended.

First, we have in the gangliated cords of the sympathetic, ganglia as follows:

1. Three pairs of ganglia in the cervical region.
2. Twelve pairs of ganglia in the thoracic region.

3. Four or five pairs of ganglia in the lumbar region.
4. Two to eight pairs of ganglia in the sacral region.

All told, we have from eighteen to twenty-five pairs of ganglia of the gangliated cords. On the other hand, we have thirty-one pairs of spinal nerves and twelve pairs of cranial nerves.

By investigation we find that the ganglia of the gangliated cords send gray rami communicantes into each and every pair of the cranial and spinal nerves. As the cranial and spinal nerves are forty-three in number, while the ganglia of the gangliated cord is much less, we find it necessary that some of the ganglia of the gangliated cords must supply two or more nerves, and this by investigation we find to be a fact.

The pair of superior cervical ganglia of the sympathetic sends gray rami communicantes into more cerebro-spinal pairs of nerves than any other ganglia of the gangliated cords, and becomes at once the most important portion of the gangliated cords for two reasons:

1. They send ganglia into more pairs of nerves than any other.

2. The superior cervical ganglia is the terminal sub-station of all the white rami communicantes of the upper stream reaching them from the upper portion of the thoracic region. It therefore becomes the great transfer station. The superior cervical ganglia send gray rami communicantes directly into the spinal nerves, as follows:

1. The first cervico-spinal pair of nerves.
2. The second cervico-spinal pair of nerves.
3. The third cervico-spinal pair of nerves.
4. The fourth cervico-spinal pair of nerves.
5. The glosso-pharyngeal cranial nerves.
6. Pneumogastric cranial nerves.
7. Hypoglossal cranial nerves.

From a continuation of the gangliated cords above, and from the superior cervical ganglia, we find the gray

rami joining many of the cranial nerves. (See Chapter III., page 36.) From the above enumeration we will see that the superior cervical ganglia, together with the extension of the gangliated cords upward, supply sixteen pairs of cerebro-spinal nerves with gray rami communicantes.

The middle pair of cervical ganglia of the sympathetic cords send gray rami communicantes into the fifth and sixth pair of cervico-spinal nerves, while the inferior cervical ganglia in the same manner supply the seventh and eighth pairs of cervico-spinal nerves. From this point below throughout the thoracic region, the twelve pair of ganglia of the gangliated cords of the sympathetic system send gray rami into the twelve pair of thoracic spinal nerves.

The first pair of ganglia supply white rami to the first pair of thoracic nerves; second to the second, and so on through the thoracic region.

In the lumbar region we have sometimes four and sometimes five pair of ganglia of the gangliated cords supplying the five pair of nerves. Often one pair of ganglia of the sympathetic cord in the lumbar region will send gray rami to two pair of the lumbar nerves, and often the lumbar nerves receive gray rami from two pair of ganglia of the gangliated cords. Hence we have not a uniform manner of connection existing between lumbo-spinal nerves and the sympathetic ganglia of the cords.

In the sacral region we have a still greater variance in the manner of the connection existing between the ganglia of the gangliated cords and sacro-spinal nerves, by means of gray rami communicantes. While the sacral nerves are uniform in number, the sacral ganglia of the gangliated cords vary considerably, and owing to the great variation of the number of ganglia in the gangliated cords in the sacral region, we would of necessity have a variation in the manner of the distribution of the gray

rami to the sacro-spinal nerves. Sometimes we have only two ganglia in the sacral portion of the gangliated cords joining and supplying five pair of sacral nerves, and one pair of coccygeal. In such cases one pair of ganglia must supply two or more of the sacral nerves. In other cases we have as many as eight pair of ganglia in the sacral region of the gangliated cords of the sympathetic, and in such cases we find two or three of the ganglia of the gangliated cords sending branches to the same sacro-spinal pair of nerves.

Gray Rami Distribution.—

An important phase of this subject remains for consideration, and that is the manner of the final distribution of the ramifying branches of the gray rami of the gangliated cords after they have joined the cerebro-spinal nerves.

1. The gray rami accompany the cerebro-spinal nerves in their peripheral distribution.

2. The white rami follow cerebro-spinal nerves back to their origin, and thus supply the nerve centers.

When a gray ramus joins either a cranial or a spinal nerve, the fibers divide, one part of which accompanies the nerve in its peripheral ramifications, and the other which passes to the origin of the nerve, and supplies the nerve center in the brain, or in the spinal cord.

A gray ramus of the gangliated cords of the sympathetic in the thoracic region, after joining a thoracic nerve, really divides its fibers into four divisions:

1. One portion going to the posterior primary division of the intercostal nerve.

2. Another division of its fibers goes to the anterior primary division of the intercostal nerve.

3. A division of the fibers goes to the posterior root of the spinal nerve.

4. Another portion of the fibers joins the anterior root of the spinal nerve, and thus the gray ramus of the

sympathetic accompanies the intercostal nerve throughout its entire zone of peripheral ramification, and it is by means of the gray rami which join the intercostal nerves and pass back to the cord, that we have a gray rami supply to the spinal segment of the origin of the nerve.

We have a like arrangement of the fibers of distribution of the gray rami which join the cranial nerves. The gray rami communicantes of the superior cervical ganglia of the gangliated cords, or of the continuation of the gangliated cords above, unite with all the cranial nerves and at the point of this union we have a division of the

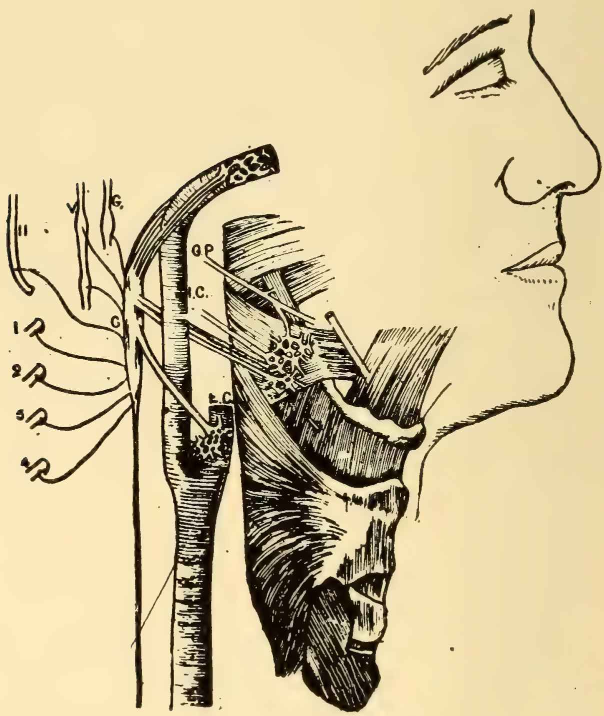


Illustration showing the connection of the superior cervical ganglion of the sympathetic system with the upper cervical nerves, some of the cranial nerves, and with the internal carotid plexus, which give communicating branches to the other cranial nerves.

gray fibers. A part of them go or accompany the cranial nerves in their peripheral ramifications, while the other fibers join and extend back to the brain, the centers from which these nerves originate.

By the above arrangement and manner of distribution of the gray rami communicantes of the sympathetic system, we find them supplying all parts of the human body peripherally, and also the central portions of the nervous system.

CHAPTER III.

THE SYMPATHETIC SYSTEM.

AS a basis for the further consideration of the functional activity of the nervous system, we wish to consider in more detail the component parts of the sympathetic division of the nervous system. We wish to outline the formation of this division of the nervous system in a new manner, to a great extent, and hope by so doing to simplify the subject and make it more comprehensive to the reader or student.

There is no division of anatomy which may be considered, that is more important than the study of the nervous system. The sympathetic division of the nervous system has not been studied much by those who make a specialty of spondylotherapy, and it is with a hope of assisting in this matter that we give the following pages to a consideration of this rather abstruse subject. We hope, however, that we can give you a mental picture of this matter which will be valuable to you.

In the study of the sympathetic division of the nervous system, we will begin by investigating the superior portions of the gangliated cords; and by this study of these portions of the cords in connection with the superior cervical ganglia, we are enabled to obtain a comprehensive view of the connection of this part of the nervous system, with the cranial nerves.

The portions of the gangliated cords above the superior cervical ganglia constitute the extreme upper portions, and terminate in the union of the cords in the ganglion of Ribes, in which is formed their commissural union.

The gangliated cords are continued upward from the superior cervical ganglia, in a plexiform manner, along

and around the external carotid arteries; and continued also in the cranial cavity in like manner along the internal carotid arteries, and it is from these internal carotid portions of the continuation of the gangliated cords, that we find their complex relation and communications with certain cranial nerves.

In this connection we will consider the superior cervical ganglia. These ganglia are about one and one half inches long, about half an inch in width, and about one fifth of an inch in thickness. They are situated in front of the transverse processes of the second and third cervical vertebræ.

These ganglia are the largest of the ganglia of the sympathetic cords, and they are the most important ganglia, because of the fact that they act as the great transfer station and terminal station of the terminal fibers of the upward stream of the white rami communicantes from the upper thoracic region; and, further, because they communicate with so many pairs of cranial and cervico-spinal nerves by way of the gray rami communicantes.

The superior cervical ganglia, directly and through the fibers coming from them and forming the internal carotid plexus, connect with all of the cranial nerves and with the four upper pairs of the cervico-spinal nerves.

The upward streams of the white rami communicantes from the thoracic segments, which pass upward and terminate in the superior cervical ganglia, are, by reason of the connections of the superior cervical ganglia with the cranial and cervico-spinal nerves, connected indirectly with all of those nerves, and it is this connection existing between the upper thoracic nerves and cranial nerves which enables us to affect the nerve supply to the organs of special sense, as we do, by relieving and stimulating them by spinal treatment.

Branches given off by the superior cervical ganglia:

1. Branches to cardiac ganglia.
2. Branches to hypoglossal nerves.
3. Branches to pharynx and larynx.
4. Branches to pneumogastric nerves.
5. Branches to upper cervico-spinal nerves.
6. Branches to external carotid nerves and plexus.
7. Branches to internal carotid nerves and plexus.

Gray rami communicantes from the superior cervical ganglia join each of the first four pairs of cervical nerves. We see from the above that the gray rami, originating in the superior cervical ganglia and in the internal carotid plexuses, communicate with all of the twelve pairs of cranial nerves, and the upper four pairs of cervico-spinal nerves.

The branches to the ganglia of Nordosum come off from the anterior surface of the superior cervical ganglia and form communicating branches with the pneumogastric nerves. The branches to the hypoglossal nerves originate from the upper end of the superior cervical ganglia and form a direct communication from the superior cervical ganglia to the hypoglossal, the twelfth pair of cranial nerves.

The internal carotid plexuses are very important, and form the extension of the gangliated cords upward to their commissural union in the ganglion of Ribes. The internal carotid branches come off from the upper end of the ganglia, and they assist in forming the carotid plexus. Now these plexuses give off the following branches:

1. To the tympanic nerves. { Superior.
2. To deep petrosal nerves. { Inferior.
3. Branches to the abducens.
4. Branches to the trochlear.
5. Branches to the ocular motor.

6. Branches to the ciliary ganglia.
7. Branches to the ophthalmic nerves.

The internal carotid plexuses, which are a continuation of the gangliated cords of the sympathetic, are very important portions because of the gray rami connections with so many of the cranial nerves.

The external carotid nerves are given off from the lower anterior portion of the superior cervical ganglia of the sympathetic, and they come from the external carotid plexuses.

Gray rami supplying the pharynx and larynx are given off from the superior cervical ganglia of the sympathetic, and they join with communicating branches from the pneumogastric nerves on both sides to supply either side of the larynx and pharynx.

The pharyngeal and laryngeal nerves are given off together, but they separate to form the two divisions, one of which supplies the larynx and the other the pharynx.

The superior, middle and inferior cervical sympathetic cardiac nerves which are given off by the three cervical ganglia of the sympathetic, are very important nerves, going directly to and entering into the formation of the cardiac plexus which supplies the viscera of the thoracic cavity.

From the above outline of the existing connections we have given, it will be seen that any interference with the superior cervical ganglia will materially affect the function of all the cranial nerves as well as of the upper cervical nerves, and will also affect the integrity of the nerve supply to the heart.

The superior cervical ganglia may be affected by lesions of the axis and atlas in a mechanical way, because of any unevenness of the bodies or transverse processes of these vertebræ due to a slight malalignment.

The most decided interference with the superior

cervical ganglia is because of an interference with the upper thoracic spinal nerves which supply white rami communicantes by means of the upward stream of communicating fibers that terminate in the superior cervical ganglia.

From the arrangement of these upward streams of the white rami, we are enabled to get some conception of how interference with the upper thoracic nerves may affect the cranial nerves, and consequently the cranial organs, such as the eyes, ears, nose, etc., as well as the organs of the tongue and upper portions of the alimentary canal.

Since the gray rami communicantes, joining the cranial nerves, distribute part of their fibers back to the brain itself, as well as to the peripheral fibers of distribution, we may conceive how by an interference with the nerves which contribute to the formation of the upper stream of the white rami, going to, and terminating in, the superior cervical ganglia, may materially interfere with the metabolic processes of the substance of the brain, and also interfere with the normal functioning of that organ.

Clinical Proofs.—

As an example of the effects of interference with the source of the white rami joining the superior cervical ganglia, we would call attention to one clinical case that came under our observation some time since: A young man who was taking a business course, was compelled to abandon work because of severe pain which was affecting the balls of his eyes. He had consulted oculists and specialists, but they could give him no help and no solution of the cause of his difficulty.

This young man called at the office of the writer, and upon examination we found a contracted condition of the spinal column, causing interference with the fifth pair of thoracic nerves. From our knowledge of the connection of the fifth pair of thoracic nerves by means of

gray rami communicantes with the superior cervical ganglia, and through this organ with the cranial nerves, we at once associated the disturbances in the eyeballs with this spinal lesion in the thoracic region.

We gave a thrust specifically directed to relieve the contraction of the musculature of this segment of the spine, and the relief from pain in the eyeballs was almost immediate. He was given spinal adjustment one week and discharged as well, although he had felt no further disturbance with the eyeballs after the first treatment.

Now this relief to the boy was quite mysterious, and when he reported at the boarding house, that the doctor had given him a punch in the back and relieved his eyes, it was quite amusing to those with whom he was associated, who could see no connection between the spinal thrust in the middle of the back and the relief given to the pain in the eyeball.

We have proven, beyond doubt, in our clinical experience in spinal adjustment, that spinal lesions in the cervical region, which interfere with cervico-spinal nerves, which send branches into the terminal ganglia of the region of the head, cause interference with the functions of the cranial nerves; and, further, it has been conclusively proven by adjustment for the relief of spinal contractions in the upper thoracic region, causing interference with thoracic nerves, which contribute white rami communicantes to the upward streams terminating in the cervical ganglia, that removing interference with these spinal nerves, positively will relieve functional derangement of the cranial nerves.

The demonstration of the above facts by means of spinal thrusts for the relief of cervical and spinal nerves, also proves that the cranial nerves depend upon the white rami communicantes from spinal nerves for their functional activity.

CARDIAC PLEXUS.

WE will now turn our attention for a few moments to a consideration of the manner of the formation of the cardiac plexus by investigating what nerves enter into its composition; and, we will also consider the terminal ganglia that are given off from it.

This is a necessary consideration, that we may intelligently locate spinal lesions which may affect the cardiac plexus and also that we may be enabled to affect the organs that are supplied by this plexus. The cardiac plexus is made up of nerves originating in the brain, and in different portions of the spinal column, which we now enumerate:

Nerves entering into the formation of the cardiac plexus:

1. Phrenic.
2. Pneumogastric.
3. Middle cervical ganglia.
4. Superior cervical ganglia.
5. The inferior cervical ganglia.
6. Rami from upper thoracic nerves.
7. Rami from upper thoracic ganglia.

Some of the nerves enumerated, originate in, and are supplied from the brain direct, while others are supplied from the cervical region, and some from the upper thoracic region of the spinal cord. By this arrangement we can see that lesions of one region which supply the cardiac plexus, do not derange or wholly cut off the nerve supply to any important organ. This arrangement of the nerve supply of the different viscera of the trunk is general, i. e., no organ gets its nerve supply entirely from any one segment of the spinal cord or of the brain, but all organs are influenced by a nerve supply from several different segments; hence, none suffer complete loss of nerve impulse

supply because of the derangement or cutting off of the supply from any one source.

In the formation of the cardiac plexus, we have the phrenic nerve coming from the middle cervical region, the principal portion of it coming from the fourth cervical pair of nerves, while the auxiliary branches entering into its formation, come from the third or fifth pair of cervical nerves.

The pneumogastric, which enters into the formation of the cardiac plexus, originates and comes from the brain, being one of the twelve pairs of cranial nerves. The pneumogastric nerve is decidedly influenced by lesions of the atlas and axis, which may affect the first and second cervical pair of nerves, as branches from these nerves join the vagus.

It may seem a little peculiar when we consider how we may relieve organs of the head and those of the special senses by relieving spinal lesions of the thoracic region; and then, again, how we may relieve the organs of the thoracic cavity by correcting lesions of the cervical region.

Spinal lesions in the thoracic region, affect the organs of the thoracic cavity, because white and gray rami from this region enter directly into the formation of the cardiac plexus, provided the lesions are of sufficient magnitude to interfere with nerves coming out therefrom.

The cervical ganglia of the sympathetic have a direct action upon the heart and lungs, but by what source impulses are transmitted to and through these ganglia, is not evident, except it be by way of the white rami communicantes from the upper thoracic nerves, via the upper stream of white rami communicantes.

The cardiac plexus does not itself connect directly with, and supply the organs of the thoracic cavity, but given off from the great cardiac plexus we have a nerve supply to these organs by means of the different terminal

ganglia that are situated in proximity to the viscera supplied, or within the walls of the viscera, as in the case of the heart. We enumerate below the terminal ganglia of the sympathetic system in the thoracic region that are formed principally from and are given off by the great cardiac plexus:

1. Esophageal plexus.
2. Deep cardiac plexus.
3. Anterior coronary plexus.
4. Posterior coronary plexus.
5. Anterior pulmonary plexus.
6. Posterior pulmonary plexus.
7. The superficial cardiac plexus.

The names of the plexuses enumerated above indicate the viscera they supply. It is well to remember, first:

That any spinal or cranial nerves which enter into the formation of the cardiac plexus, have an important function to fill in maintaining the integrity of the action of this great plexus, and of the terminal ganglia that are given off from it.

Second. It is well to remember another fact, which is, that any lesions of the spine, affecting nerves from any of its segments, which join into the formation of the cardiac plexus, will affect the functioning of the organs supplied by the cardiac plexus, either directly or through the terminal ganglia given off from it.

THE EPIGASTRIC PLEXUS.

THE epigastric, or solar plexus, is an important plexus or ganglia of the sympathetic system which is situated within the abdominal cavity, and supplies the viscera contained therein. The zone supplied by the solar plexus is the largest anatomical area supplied by any of the great ganglia of the sympathetic. The

epigastric plexus is made up of nerves from different portions of the brain and spinal cord. We enumerate below the principal nerves that enter into the formation of the solar plexus, as follows:

1. Phrenic.
2. Pneumogastric.
3. Great splanchnic.
4. Lesser splanchnic.
5. Smallest splanchnic.
6. Thoracic nerves rami.
7. Thoracic ganglia rami.

The formation of the epigastric, or solar plexus, is similar to that of the formation of the cardiac plexus. The cranial and cervical nerves which join into the formation of the cardiac plexus, join also in the formation of the solar plexus. The rami from the lower segments of the thoracic region, and the ganglia of the lower thoracic portion of the gangliated cords, enter into the formation of the solar plexus, while the white and gray rami of the upper portion of the thoracic region enter into the formation of the cardiac plexus.

The great splanchnic nerves are given off from the fifth to ninth pairs of ganglia of the sympathetic cords.

The lesser splanchnic nerves are given off from the tenth and eleventh pairs of ganglia of the sympathetic cords.

The third, or least splanchnic, comes from the twelfth pair of sympathetic ganglia of the thoracic region.

The dividing line between the formation of the cardiac plexus and the solar plexus in the thoracic region, is at the sixth thoracic vertebra, and this is another mark indicating the central segment of the spinal cord, and the central place of the great reflex portion of the nervous system.

The epigastric plexus, like the cardiac plexus, supplies

the viscera of the abdominal cavity, principally by giving off terminal ganglia to supply the different viscera. We enumerate the principal ganglia of the epigastric plexus, situated in the abdominal cavity, as follows:

1. Cœliac plexus. Liver. Spleen. Stomach.
2. Aortic plexus.
3. Renal plexus.
4. Adrenal plexus.
5. Spermatic plexus.
6. Mesenteric plexus.
7. Diaphragmatic plexus.

The aortic plexus of the terminal ganglia is situated in the upper portion of the abdominal cavity, and it forms a plexiform arrangement around the abdominal aorta.

The renal and adrenal ganglia supply respectively the kidneys and supra-renal capsules and are terminal ganglia situated in the lower portion of the abdominal cavity.

The spermatic and mesenteric terminal ganglia supply the spermatic cords, and mesentery of the intestines.

The phrenic, or diaphragmatic, ganglia influence the functioning of the diaphragm.

The cœliac plexus supplies and regulates the action of the stomach, liver, spleen, and conjointly with the above terminal ganglia, affect the vasomotor action of the viscera of the abdominal cavity.

Now there is one other feature of the nerve supply entering into the formation of the epigastric and cardiac plexuses which exercises a decided influence upon the viscera of these cavities.

First: We have given off from the spinal nerves from the lower segment of the thoracic region, from the ninth to the eleventh thoracic nerves, branches which

connect with the terminal fibers of the phrenic nerves in the adrenal plexuses. Impulses from these segments of the spinal cord are carried by the afferent fibers of the phrenic nerves from above, and we find that kidney diseases are associated with derangement both functional and organic, of the heart, and in extreme cases we have pleuritic effusions and accumulations in the lower part of the lungs associated with spinal lesions affecting the nerve supply to the kidney which communicates with the terminal fibers of the phrenics.

It is a well recognized fact among physicians generally that there is a connection between conditions of the pelvic organs and conditions of the brain. Now this can come about in two ways:

First, lesions of the lower thoracic region which interfere with nerves whose filaments join the terminal branches of the phrenics have an action upon the general circulation of the thoracic cavity.

The circulation of the thoracic cavity has a compensatory influence upon the circulation of the brain. The connection of the lower thoracic nerves with the phrenic nerves affects both the circulation of the brain and the circulation of the thoracic cavity, when they are disturbed by spinal lesions in the kidney region.

Again, terminal filaments of the pneumogastric mingle with branches of the lumbar nerves, in the structures of the pelvic plexus. Impulses by way of the lumbar nerves when joining terminal filaments of the vagus in the pelvic plexus, are carried by the afferent fibers of that nerve back to the solar plexus affecting the integrity of the functions of the organs of the thoracic cavity.

The potency of the influence of the connections just referred to, are often verified by the phenomena of gastric and cardiac functional derangement witnessed in clinical examinations.

THE PELVIC PLEXUS.

THE pelvic plexus is situated within and supplies the organs of the pelvic cavity. In its formation it resembles somewhat that of the cardiac and epigastric plexuses, receiving, as it does, fibers from the brain and from different segments of the spinal cord.

We enumerate the different nerves which send branches into the formation of the pelvic plexus, as follows:

1. Hypogastric plexus.
2. Rami of sacral nerves.
3. Rami of lumbar nerves.
4. Rami of sacral ganglia.
5. Rami of lumbar ganglia.
6. Rami of thoracic nerves.
7. Terminal branches of vagus.

The pneumogastric enters the pelvic plexus principally through the hypogastric plexus. The hypogastric plexus is a continuation of the solar plexus, and the foundation of the formation of the pelvic plexus. It forms the connecting link of the fibers of the solar plexus with the pelvic plexus, where terminal filaments of the vagus connect with filaments from the lumbar nerves. This connection solves the problem of why we have associated with pelvic disturbances in pregnancy the phenomena of gastric disturbances, and also furnishes an insight of how lesions of sexual organs cause aberrations of the mental faculties.

Now in the formation of the pelvic plexus we have fibers from the brain by way of the vagi, and nerve impulses over these nerves may be influenced by spinal lesions in the cervical region affecting the first and second cervico-spinal pair of nerves which supply communicating branches of the vagi. Also, because of the interference with the source of the downward stream of

white rami communicantes from the lower thoracic region, which has a connection with the pelvic plexus, there will be derangement of the function of the organs supplied by this portion of the sympathetic.

The white and gray rami from lumbar and sacral nerves enter directly into the formation of the pelvic or hypogastric plexus. This plexus, like the solar and cardiac plexuses, in their respective zones, supplies the viscera of the pelvic cavity principally by giving off terminal ganglia, and we enumerate the terminal ganglia given off from the pelvic plexus, as follows:

1. Vesical plexus.
2. Vaginal plexus.
3. Uterine plexus.
4. Prostatic plexus.
5. Plexus cavernosus.
6. Plexus differential.
7. Plexus hemorrhoidal.

The names of the plexuses enumerated above indicate clearly the viscera they supply. It is well to remember that while there are nerve filaments from different segments of the cerebro-spinal system entering into the formation of the great plexuses, as the cardiac, solar and pelvic, there are certain nerves that enter more directly into these plexuses, or into certain parts of these plexuses, and also affect more directly the special terminal ganglia that supply the different viscera.

We might consider, on the one hand, that we have an indirect nerve supply, and, on the other hand, a direct nerve supply to any one viscus, and the direct supply will have decidedly the most influence upon the functional activity of the organ supplied.

For example: The vesical plexus, which is a terminal ganglion given off from the pelvic plexus, is influenced mostly by the first pair of lumbar nerves, while the uterine plexus, which is another one of the terminal

plexuses given off from the pelvic plexus, is influenced mostly by the fourth pair of lumbar nerves, and the same is true of the other plexuses which are formed from the pelvic plexus.

As an example of the influence of the first pair of lumbar nerves upon the vesical plexus and the bladder, we will call your attention to a case of enuresis. This case was called to our attention by a brother physician in California. He had recently learned of the effect upon the function of the internal organs by spinal treatment, and after giving one adjustment to a child who had been troubled with enuresis for six years, the boy was entirely relieved.

Some of the worst cases of cystitis yield to spinal treatment, which overcomes interference with the first pair of lumbar nerves.

The several terminal plexuses of the pelvic region are quite decidedly influenced by white rami given off by the lumbar and sacral spinal nerves that pass directly to and join them.

Certain lumbar nerves directly influence certain terminal ganglia, hence we get more direct and specific action upon certain viscera through certain nerves.

As examples of the above we mention the spinal action of the first lumbar nerves upon the bladder.

The special action of the second pair of lumbar nerves upon the colon, appendix, inguinal canal, etc.

The special action of the third pair of lumbar nerves upon the ovaries and testicles.

The special influence of the fourth pair of lumbar nerves upon the uterus.

The special influence of the fifth pair of lumbar nerves upon the rectum and joints of the lower extremities.

CHAPTER IV.

FUNCTION OF NERVES.

HEALTH is essentially a phenomenon of normal function, while disease is the phenomenon of deranged function.

Since all function is the result of nerve impulse, the study of the function of nerves becomes at once one of the most important subjects in connection with health or disease.

A further phase of this subject which lends importance to the study of the function of nerves, is the fact that the histological condition of all organs and parts of the body is dependent upon the processes of metabolism, which is entirely governed by nerve function; hence normal structural condition is the result of the normal function of nerves and the normal metabolic processes. Derangement, or alteration of the histological elements of any organ or part, is caused by a derangement of the processes of metabolism, which is due to an interference with the nerve supply.

That property of a living nerve by which it is enabled to transmit impulse, is known as "conductivity." As a result of the histological arrangement of the motor nerves, they are capable of conducting impulses only in a centrifugal direction, while sensory nerves are only capable of conducting impulses in a centripetal direction.

Nerves, normally, transmit impulses only in one direction, except they may act as inanimate conductors, in which case they may conduct in both directions, which phenomenon is known as double conduction.

The difference in the direction in which nerves conduct impulses constitutes the primary division of the nervous system as to function, namely: Afferent and efferent.

The impulse which is conducted by either afferent or efferent nerves, we choose to denominate "nerve impulse," although other names have been applied to this phenomenon. By some it has been termed "mental force," "mental impulse," or "mental energy," either of which may be a proper name for an impulse that arises automatically within the brain centers, but would naturally be limited in use to when referring to an impulse of this nature.

The term "nerve impulse" is wider in its application, and applies to impulses generated by excitation of the peripheral endings of the afferent nerves, and will also apply to the nerve impulse generated automatically by the nerve centers of the brain.

The afferent nerve action embraces impulses excited peripherally by stimuli and conducted centripetally, and other receptive functions of the brain, and may be divided as follows:

Afferent Functions:

- I. Seeing.
- II. Tasting.
- III. Feeling.
- IV. Hearing.
- V. Smelling.
- VI. Intuition.
- VII. Inspiration.

The above classification is not what we have been accustomed to in our text-books, as ordinarily we see the first five of the above enumeration, classed as special senses. This is true; they are special senses, but they are also the result of afferent action of nerves, and classify correctly as the afferent functions of nerves.

In enumerating the afferent or receptive powers of the nervous system, we embrace not only the five special senses, but two other powers of the mind that evidently exist, and will classify under the heading, viz., afferent function of nerves.

VI. Intuition.—This is a power of the mind that is recognized, and means essentially the capability of the mind to know without being taught. It is the automatic intelligence which enables birds to build nests, and to care for their young without previous instruction. It is that power of the mind which enables a pig to return to its sty without a guide. Instinct or intuition is that power of the human mind by which one is enabled to decide questions upon the spur of the moment without stopping to reason.

Instinct is the principal controlling power in a great many lower forms of animal life, while reason becomes the main controlling power in the higher forms of animal life.

VII. Inspiration.—Inspiration is a knowledge which is given us from some source without, and we may not know from what source. It is said in the Bible that all Scripture was given by inspiration of God. We understand this to mean that the prophets received their instruction from the Holy Ghost.

Through inspiration we are frequently cognizant of a certain fact or facts, when we cannot determine by what means or through what medium the knowledge has been conveyed to our minds. We have heard of incidents of fathers or mothers who would know of the death of a son in a foreign land without any conception of the source from whence they obtained this knowledge. From personal experience I will cite one case as an example of this function of the mind.

The writer had treated a case of tuberculosis, which was subsequently, at the time of death, in an adjoining State. The evening before the death of this patient we had a brief conversation, concerning her, at the dinner

table. It was contended by some present that she would recover, in time, from her sickness. The next morning, as the writer took his seat at the breakfast table, he remarked to the crowd assembled there, that this patient was dead.

We knew this was so, but did not know why, nor how we knew it. Three days later a paper came from the town where the patient resided, which announced her death, which had occurred about midnight after the dinner at which her case had been discussed. A day or two later a letter was received from the sister of the patient, who lived several hundred miles further south, stating, "I have not heard a word from home; but I know that sister is dead." A similar letter came from another sister who was living about two hundred miles north of the home of the patient. It expressed the same sentiment: "I know that sister is dead, although I have not heard a word from home." Such cases are too numerous and too well known to need further citation; but we must concede that there is some source of receiving information that is not wholly understood.

It is well to remember that the term "inspiration," which expresses this power of the mind, is broad enough in its meaning to embrace functions of this nature, whether they be from good or from evil sources.

The other afferent functions known as the special senses, do not need special mention in this connection, more than to say that the functioning of the brain in any of these channels is responsible for the existence of these afferent and receptive powers.

Any interference with the brain, through circulation or otherwise, interferes with these functions. Certain centers of the brain seem to preside over the different functions enumerated above.

CRANIAL NERVE FUNCTIONS.

WE have proven conclusively to our own mind during the past three or four years, that spinal nerves from the cervical and dorsal regions, have a decided, positive, and very important effect upon the functioning of the cranial nerves or their centers, which are responsible for the afferent functions of the cranial nerves and brain.

We have restored power of vision to eyes that were wholly blind. We have restored power of hearing to ears that were almost and sometimes wholly deaf. We have restored the function of smell and taste to parties who had lost these functions several years previous.

We have demonstrated the influence of the cervico-spinal nerves upon cranial nerves in our clinical experiences repeatedly, until we have learned to know that the optic nerve, auditory nerve, gustatory nerve, and olfactory nerve and other cranial nerves, will not respond to afferent stimulation, nor perform the functions for which they are intended, except when the filaments joining them, which are given off from the cervical and thoracic nerves, are free from interference, and possessing normal excitability and perfect conductivity. We will mention in this connection some clinical cases which demonstrate the correctness of the above statement:

BLINDNESS.—A druggist, about fifty years of age, had suffered the loss of the power of vision in an eye, and this was claimed to be due to paralysis of the optic nerve. This patient had been under the care of specialists for about eight years, when he lost the use of the other eye. This left him in total blindness. He applied at our office for treatment, and in two or three days' time, the eye which had lost the power of vision was sufficiently relieved from the lesions causing the trouble, that he could appreciate daylight and distinguish objects. Within

one week's time he could see his way on the streets and could see fairly well even in the dark hallway adjoining our office rooms. After a month's treatment he had no difficulty in reading the signs along the street, could see fairly well, and returned to his home to take charge of his drug business.

Another case which illustrates the effects of spinal lesions upon the power of vision or function of the optic nerve, was one that the writer treated while on a visit to Ocean Grove, New Jersey. This gentleman was about fifty years of age, and had suffered a stroke of paralysis five years previous to the time he came under the attention of the writer. Since the stroke of paralysis he had become totally blind in one eye. After a single treatment, in which we relieved a contracted condition in the cervical region, which affected the middle cervical nerves, he was enabled to see daylight, and could even see a postcard across the room in his office when he returned to New York City the day after the first treatment. Within a week's time, vision was restored to the eye that had been blind for five years, until this man could recognize his friends, the color of their clothing, neckties, etc., while the good eye was obstructed or covered.

Another case which we treated some three years past, illustrates the effect of the spinal nerve supply upon the visual organs: A minister from an adjoining state suffered with very defective vision, in which the area of vision was very restricted. He could see only one hand of a watch at a time, and it was necessary for him to turn the watch around in order to bring the other hand into the visual field that he might be able to tell the time of day. His vision was acute enough, but the field of vision was very much contracted. After one week's treatment, he could easily see the face of the entire watch, or the face of a clock, at the same instant. Before this treatment, in reading signs, he would have

to read one letter at a time. After one week's treatment he could see the whole sign at the same time.

We might mention one other case as additional proof of the correctness of our statement above concerning cervical and thoracic nerves affecting the power and function of cranial nerves, but we almost fear to do so for fear of inciting disbelief, but "truth crushed to earth will rise again."

A gentleman about thirty-five years of age began to lose his eyesight. For a moment he would go blind, but vision would return again. This continued for a number of days, when one of the eyes failed to recover, but remained in darkness. A few days later the other eye went blind and remained so, and the man was left in total darkness. He consulted specialists of Oklahoma City, but received no encouragement. He was told that he would go through life blind. In this condition he was brought to the office of the writer. A visiting doctor conducted the examination, and gave the first treatment. The writer gave the subsequent treatments for a period of one week. As a result of the first treatment, the power of vision was restored in one eye, until he could find the name of the writer in a telephone directory, and called to inform him that his eyesight was returning. After the second treatment he was enabled to read, with either eye, a diploma that hung across the room. After a week's treatment he could read the newspapers without glasses, notwithstanding the fact that he had worn glasses for twenty years before he was stricken blind.

Deafness.—We have had a variable experience in the treatment of deafness by spinal adjustment. Many cases of deafness respond very quickly when we relieve interference with the nerve supply from the cervical and dorsal regions which join and influence the auditory nerves.

There are many cases of catarrhal deafness which

will not respond to spinal treatment, or will respond very slowly. This seems to be due to the fact of the pathological changes which have taken place in the inner ear as the result of the deranged functional processes associated with catarrh, but the many cases of deafness which respond to treatment that is directed toward the relief of spinal nerve supply, prove conclusively that these nerves have a decided and potent influence upon the action of the nerves of this special sense.

Taste and Smell.—These functions are associated more or less closely, and affected practically by the same nerve supply. We have learned, by clinical experience, that we can restore the sense of taste to those who have lost this function, by relieving all interference with cervical and thoracic spinal nerves. We have had a number of patients who were suffering with anosmia, and were void of the sense of taste, and the almost invariable result of treatment has been to restore these functions. We will cite one case which establishes the correctness of this claim:

An undertaker from Long Island was visiting at Ocean Grove, N. J. The writer, who was visiting this place at the same time, gave this party one week's spinal treatment for the purpose of relieving him of neurasthenia. After a week's adjustment, the party was surprised to find that he had restored to him the sense of taste and smell, functions that he had lost several years before.

Feeling.—The function of the sense of touch or feeling is general throughout the body, and is exclusively a function of afferent nerves, and it is a known fact to clinicians that the acuteness of the sense of feeling depends upon the excitability of the nervous system. The loss of the sense of feeling is due to paralysis of the nerve supply to the zone in which the sensation of feeling is lost. Feeling, on the other hand, may be increased above the

normal, which is also due to a nerve interference, or rather to an irritation of the nerves, as in case of inflammation. The sense of feeling we divide as follows:

1. Sense of pain.
2. Sense of thirst.
3. Sense of weight.
4. Sense of hunger.
5. Sense of pressure.
6. Sense of pleasure.
7. Sense of temperature.

All of the above phases of the sense of feeling are alike due to the integrity of the afferent nerve supply, and all are deficient in proportion to interference with the nerve supply that decreases either the excitability of afferent nerves or depresses their conductivity. Inflammatory or excitable conditions of the nervous system will magnify these functions.

As stated above, disease is essentially a phenomenon of deranged function. All of the afferent functions of nerves which we have considered above, are directly due to the condition of the nerve supply.

Without the nerve function, none of the afferent functions would be manifest, and since all of these functions are controlled by the spinal nerve supply, and as at the spine is the place where the nerves are usually interfered with, we are at once driven to the conclusion that spondylotherapy is the most logical, the most sensible, and the most potent treatment for good which has ever been brought to the attention of the practitioners of the healing art.

CHAPTER V.

EFFERENT FUNCTIONS OF NERVES.

A THOROUGH understanding of the efferent functional phenomena of the nervous system is very necessary to a proper understanding of the effects of interference with the nerve supply.

We now consider the efferent functions of nerves briefly. In order to get this subject before us in the quickest way, we will enumerate the primary divisions of the efferent functions:

EFFERENT FUNCTION:
- I. Motor.
- II. Mental.
- III. Trophic.
- IV. Thermic.
- V. Secretory.
- VI. Excretory.
- VII. Inhibitory.

Here the same point as was mentioned in the foregoing chapter concerning afferent function, might be considered with reference to efferent function, namely: All function is the result of nerve impulse. Without nerve action there would be none of the efferent functions. Any interference with nerve supply will interfere with the efferent functions enumerated above.

As the spine is the place where nerves are usually interfered with, we are again brought to the conclusion that spinal treatment which tends to remove interference with the nerves where they are given off from the neural canal, is the most rational and most potent treatment that has ever been discovered.

I. MOTOR.—By this function is meant that character of impulse which excites contraction of muscles and other tissues. There is no movement of the body, except that

which is produced by muscular contraction. We cannot move a hand, nor foot, nor muscle, nor any part of the body, without muscular contraction, which is due to the motor impulse of the nerve supply.

Motor function may be divided into the following subdivisions:

1. Myomotor.
2. Pilomotor.
3. Vasomotor.
4. Cardiomotor.
5. Visceromotor.
6. Secreto-motor.
7. Inhibito-motor.

In the above division, the names given are those that are indicated by the nature of the tissue supplied by the motor nerve.

1. Myomotor.—By the term myomotor we refer to motor nerve impulses which affect contraction of the muscular tissues in which the nerves terminate.

2. Pilomotor.—These impulses cause movement of the hair by causing contraction of the erectores pilorum.

3. Vasomotor.—Vasomotor impulses affect the mobility of the non-striated muscles of the walls of the vascular system, and affect the tension of the blood vessels, causing vasoconstriction.

4. Cardiomotor.—By cardiomotor function we refer to impulses contracting the muscular walls of the heart. A lack of the cardiomotor impulse produces pathological conditions, such as dilatation of the heart.

5. Visceromotor.—Visceromotor impulses control the tonicity and peristaltic action of the abdominal viscera. Interference with visceromotor function is responsible for diarrhea, dysentery, as well as chronic constipation. A lack of visceromotor impulses constitutes a predisposing cause of the invasion of disease, due to infections such as typhoid fever and appendicitis and

such conditions as hernia and prolapsus of the intestines and bowels and other viscera.

6. Secreto-motor.—By secreto-motor we refer to those nerve impulses that produce motor action which controls the glandular activity of the body, and the glandular secretions of the different mucous and serous lining membranes. Any interference of the secreto-motor impulses to the nasal cavity, is responsible for derangement of the functions of these organs and all diseased conditions, and so on throughout all of the mucous membranes of the body.

7. Inhibito-motor.—This is a motor function, or an active function on the part of the motor nervous system, which controls or regulates the action and all the functions of the nerves. If it were not for the inhibito-motor influences, the reflex action would be increased in amount, and all of the reflex response to afferent stimulation would result in an excessive reflex response.

In order to correct interference with any of the phases of motor action, it is only necessary to remove all interference with the nerve supply, and that usually necessitates the employment of some method of spinal treatment, of which spinal adjustment is decidedly the most potent.

II. Mental.—The mental functions are most interesting. To the human mind there is no subject more interesting than that of the origination of thought and all mental function and activity.

In the first place, there is a very positive relation existing between the mind—a non-physical—with the brain, a physical organ.

It is argued by one set of physiologists or psychologists that the brain is formed and fashioned by the mind. By other anatomists, physiologists and psychologists, it is confidently claimed that the mind and all mental faculties are originated by, and are the products of, the brain's action.

Going further with these divergent views, we might compare the relation of brain and the production of mind to music produced by different musical instruments, as the violin, mandolin, guitar, etc., on the one hand, and such an instrument as the æolin harp on the other. All of the above instruments are prepared for the production of music by stretching cat gut strings over openings in specially shaped wooden structures.

Now the music of the mandolin, violin or guitar, is produced by an artist who uses these instruments. The musician is the exciting cause and the originator of the music, while the instrument is but a tool in his hand.

With the æolian harp, the instrument is receptive and sensitive to breezes or atmospheric pressure, so that from moving currents of air different strains of music are produced, depending upon the direction, force, and velocity of the currents. In this case, the instrument becomes the originator of musical sounds, and also the producer of music.

In the first instance we have an intelligence as the exciting agency, while in the second instance we have the non-intelligent zephyrs from atmospheric movement that excite vibrations which produce music.

Just so certain persons claim there is an entity of spirit, an innate intelligence or subconscious mind that is separate from, and independent of the brain, and that these spirits use the brain as an instrument for the production of thought, while others claim that the brain originates and produces thought and all mental action as the result of afferent impulses received through the different afferent nerve functions, or the brain cells, originate thought *de novo.*

In one case, the physical brain would be the instrument, while in the other instance the brain would be the agent. It is hard, indeed, to arrive at correct conclusions as to the origin of mental manifestations by the study

of abstract mental phenomena. Therefore the study of the mind cannot be successfully pursued by a study of its own operations, or productions, no more than we can understand the manner in which a telegram is originated and sent by studying the telegram that is received and read.

We may trace the telegraph wire back to its beginning, and thus discover the mechanism which generates, and the wire which transmits the words of the telegram, so we may by an examination and a study of the brain, determine something of its component parts and its many functions.

HISTORICAL.

BEFORE making an analytical study of brain functions, we feel that it may be of interest to call attention of the reader to some of the opinions recorded in historical data concerning mind, its location, and its connection with the functions of the brain:

The Babylonians were the first people in the world, so far as historical records show, who located the origin of the mind within any vital organ. It was thought by them that the mind was connected with the liver and that it constituted the seat of intelligence.

We next read of the Hebrews, who considered the heart the seat of the soul, and the kidneys the seat of the mind, and that all tender emotions originated in the bowels. Thus we read in the book of David—the Psalms—that "The Lord tryeth the heart and the kidneys."

The prophet Jeremiah upbraids the hypocrites of his time, who "had the Lord in their mouths, but not in their kidneys." "Bowels of mercy," is an expression of St. Paul that we find recorded in the New Testament.

Other nations of the world seem to have had vague

ideas as to the location of the mind, however. Plato, of the Greek nation, claimed that the brain was the supreme seat of the mind, but his ideas seemed to be very vague, as he confounded the substance of the brain and the spinal cord with the marrow of bones.

Aristotle, however, who was a physiologist, and the son of a physician, decided that Plato had evolved in his own mind his theory without considering facts that would lead to the truth of the matter; he, therefore, decided that the brain was an organ for cooling the blood of the heart, and that the brain functions had nothing to do with the generation of thought or mind. He discovered that the brain was apparently an inexcitable and insensible organ, while the heart manifested considerable excitability; he also was aware of the fact that consciousness was interfered with by the heated blood of fevers, or by blood poisoning, and therefore decided that the blood contained the conscious mind, and the heart, the central organ of circulation, was the seat of the soul.

These beliefs held sway for centuries. There were many ideas advanced and were extant during these centuries concerning the blood, giving to the different viscera of the abdominal cavity certain functions, such as attributing the appetite and emotions to the liver, spleen, stomach, intestines, etc.

While the dark clouds of ignorance were hanging heavily, and while many erroneous views were believed and taught, we find a man by the name of Alcmæon, who lived about 500 B. C., teaching that the brain was the sole seat of the mind and all motion and feeling. He also maintained that sensations were carried to the brain by means of nerves. This conclusion was reached by experiments in which he had severed the nerves leading to and from the brain.

The views of Alcmæon, although correct, have, as later investigation demonstrated, seemed to be far in

advance of the day in which he lived, and his works were alluded to by Plato and Aristotle in a contemptuous manner.

Some 300 years B. C., a school of experimental anatomy and physiology arose in Alexandria. Leaders in this school dissected the brain, very carefully tracing to it the nerves of special sense, and advanced so far as to divide the nerves as to functions, into sensory and motor, and prepared the way for the final overthrow of the doctrine of the brain, as taught by Aristotle.

Galen, A. D. 160, overthrew the doctrine of Aristotle concerning the brain. This physician established the doctrine which still survives, i. e., that the brain is the seat of thought and mind and feeling. A contemporary of his demonstrated that the brain directed muscular movements, and made considerable study of the brain connection with lesions of paralysis, but he held to the old view that the heart was the seat of the soul.

There seems to have existed in this age of the world certain ideas that were a bar to advancement, and to any intelligent idea of the brain and its functions. These ideas were based upon a knowledge of the then known fact, that the arteries were empty after death. The commonly accepted opinion of that day and time was, that the arteries were air chambers, and were for the abode of spirits which were transferred back and forth from the heart to all parts of the body. These opinions as to the all-prevailing power of the vital spirits, or intelligences, and of functions being produced thereby, was the great barrier that for many, many centuries obscured the minds of the psychologists and kept the world in ignorance.

Even to-day these same doctrines are held by some psychologists who vary from the view of Hippocrates and Aristotle, only in the location or habitat of these spirits or intelligences. Instead of the arteries being the channels of transition of spirits, as was believed by the ancients,

or, as Descartes attributed to animal spirits, transmitted by arteries, and acting upon tissues, all functions, whether normal or abnormal, so some of our latter day psychologists attribute all function to an intelligence, or subconscious mind, which they claim is transmitted by, and acts through the pathways of the nerves.

III. Trophic.—The trophic action of nerves is not thoroughly understood. The writer fully believes that the trophic functions of nerves are due principally to that division of the nervous system known as the abdominal brain, or the sympathetic nervous system, and further, we know that the trophic action of nerves is purely an involuntary action upon the part of the nervous mechanism.

We do not thoroughly understand the nerve endings, nor the manner in which they function, nor their situation in the tissues themselves, whose normal metabolism, growth, and intact existence they control.

Considerable work has been done to demonstrate the trophic influence of special nerves. Enough has been done to prove conclusively that the nourishment and repair of all tissues and parts of the body, are directly dependent upon the trophic function of nerves. Even the growth of bone is known to be influenced by the influence of nerve impulse. In fact, all tissues, and even the nerves themselves, must be supplied with the trophic impulses of nerves, that their existence may be maintained intact—that their action be not impaired or destroyed.

CHAPTER VI.

THERMIC FUNCTION.

THE thermic function of nerves is the cause of the phenomenon by which potential and kinetic energy are made available in the form of caloric heat units, which is necessary to the maintenance of the uniform temperature in the case of animal life while in health, especially those whose temperature is normally equitable.

Chemic changes which are continually taking place in the cellular tissues of the living body, are attended by the evolution of heat. Potential energy in the nutrient substances which we consume, may be appropriately designated as latent heat. Mechanical energy and electricity are developed from potential energy.

The processes of metabolic transformation, of a chemical nature, of food combinations, reduce or exhaust the potential energy contained, from which source is derived the mechanical and electric energy.

All processes of metabolism and all changes occurring in the way of heat production, are the direct result of nerve impulse, and the nerve impulses, tending to the maintenance of the uniformity of the bodily heat, are automatically generated in the nerve centers, and augmented by physical activity and the consequent chemic and thermic changes. We affect the bodily temperature almost immediately by stimulating the nerve centers, which give off the physiological impulses which are being continually, automatically originated and given off.

As examples of the effects of spinal adjustment, we copy a short chapter from "Spinal Adjustment" (Gregory):

A woman with cold hands came into our office; her hands continued cold, notwithstanding the fact that she

was otherwise warm and comfortable. A thrust was given to relax the ligaments that were contracted and approximating the first and second thoracic vertebræ, thereby freeing the first pair of dorsal nerves, and this caused the arms to become warm in a few minutes' time.

Another case which came into our office, was that of a lady whose lower limbs had been cold and numb for eighteen years, ever since suffering with puerperal fever, following her last childbirth.

She spoke of the condition of her limbs, but voluntarily and immediately assured us that we could never cause her feet and legs to feel and remain warm again. We assured her that we could renew the vital processes in those limbs and restore in them a normal thermic condition, and after that they would become warm and remain so continually. After we had succeeded in relaxing the ligaments of the lumbar vertebræ and overcoming their contracted and approximated condition, the limbs in three days' time became warm and comfortable, to the amazement and pleasure of our patient; in fact, there was a slight excessive thermic activity and temperature in those limbs for several days.

A young man who was taking spinal adjustment of us, came to the office one morning, and upon inquiry complained of feeling chilly, but said that this was because his blood was thin. After treatment he began perspiring gently, and when asked how he felt, he replied that he was perfectly warm. The author then asked, "Do you know what I have done for you?" The patient replied, "No." We then told him we had thickened his blood for him. Thus was his idea, that thin blood caused chilliness, exploded. We had really stimulated thermogenetic action and heat production throughout his system, and this was responsible for the normal thermogenesis that immediately ensued.

Often during the past three years we have had

patients come to us with cold feet and legs, or cold hands and arms—either one, or both—and in every case, after freeing the spinal nerve supply, the cold extremity would again become and remain warm and comfortable.

All warm-blooded, or homeothermic animals, in all latitudes and in all kinds of weather, summer or winter, maintain a uniform temperature in all parts of their bodies when in a state of health. Now the questions arise: How is the necessary heat generated or produced in the body? How is the body maintained at a uniform temperature?

At one time a doctor was adjusting a subluxated vertebra which was interfering with the spinal nerve supply into one arm. As a result of the impingement of this nerve, the arm was cold, numb and unnourished. When the adjustment was made in the presence of three or four persons, for the relief of the nerve, the arm quickly became warm. The thermic action set up in this arm, and the warmth which ensued, were so marked as to excite the immediate attention of the patient, of the doctor, and of the witnesses who were present.

But another phenomenon to be remembered in connection with this, is, that the other arm, which had, previous to this time, been of normal temperature, became cold. The subluxated vertebra had been thrown laterally a little too far, and while this relieved the interference with the nerve which supplied the trophic supply and functions of the one arm which had been cold, the doctor thereby had caused interference with the nerve supply to the other arm, decreasing at once the specific and thermic function going on within it.

The doctor thought for a few moments, and asked the persons present what caused the production of heat. They answered, "the nerves," and the doctor arrived at this same conclusion. This party seems to have reached this conclusion because of the fact that when the nerves

are relieved from pressure or impingement, normal warmth is restored to a limb or extremity that is supplied by this nerve.

The conclusion was, that the nerve under impingement could not heat the limb, and consequently the limb became cold. When the nerve was relieved, the temperature of that portion of the body at once became normal. To the uneducated mind, the conclusion that the nerves heat the body, is easily reached, but to the better educated, such an idea does not appeal.

Heat is produced in all portions of the body. The larger portion of heat is produced in the muscles; next to the muscles in heat production, come the glands, more especially the liver.

The production of heat is under control of the thermogenetic centers of the nervous system. Nerves control the processes of metabolism which liberate the stored potential energy in food that is digested and assimilated, and hence control or regulate the temperature of the body, but do not produce heat *per se.*

The maintenance of a uniform temperature of the body depends upon the generation of heat keeping pace with the heat loss. Both heat production and heat loss are variable, but when they keep pace with each other, we maintain a normal temperature; but in cases of failure of this adjustment, we have either a rise of temperature, or fever, or we may have a subnormal temperature.

Nerves are not producers of heat, but control the processes of metabolism, which produce and liberate heat. The nerves maintain a normal temperature in health by heat generated through action they themselves produce and regulate.

The blood is the chief medium of distribution of nutrition, carrying the nourishment to all tissues of the body. Nerves cannot act or perform any function except

they are nourished by the blood stream. If you sever or tie, or in any way occlude the artery supplying a nerve, you will destroy the action or excitability of that nerve; if you then remove the occlusion and restore the nutrient supply to the nerve or to its center of origin, you will thereby restore the excitability of that nerve or nerves. We can then come to but one conclusion, and that is what the Bible says: "The blood is the life." Some think the blood heats the body—that thin blood causes chilliness and inability to withstand exposure to cold, except with great discomfort; some think that thick blood produces plenty of heat. These ideas are certainly erroneous. This reminds us of the case cited above, of the patient who once said to the writer: "I am so chilly, and it is because my blood is thin." Soon after his adjustment he felt comfortably warm. Now what caused the difference in his feeling so soon? I suggested to him that I had thickened his blood; this suggestion was in harmony with his idea of being chilly because his blood was thin. Now what had I done? I had, by giving him an adjustment, stimulated his central nervous system, and re-established the normal processes of metabolism, thereby restoring ample heat production throughout his body, and consequently normal warmth and comfort.

Much stress has been laid on chemical action or combustion going on after eating a diet consisting of free fat. This action going on throughout the human organism is considered an important agency in heat production. Many hold to the idea of the necessity of consuming much fat as an article of diet to furnish fuel for combustion, that the body may, by this means, produce and maintain sufficient warmth. Cattle, horses, sheep, and all herbivorous animals, maintain a uniform thermic condition of their bodies, in all kinds of weather and

during all kinds of exposure, but they do not use as an article of diet, any free fat.

Carnivorous animals, which prefer a meat diet, consisting of a greater or less extent of fat, do not withstand cold any better than (nor as well as) herbivorous animals. From the above, students of nature should learn the lesson that the consumption of free fat is no indispensable assistant in the production and maintenance of normal bodily temperature.

Many think that alcohol and other stimulating drinks keep the body warm. They imbibe freely on cold days, thinking that by so doing they can better withstand the cold weather. Wine is a mocker; those worshiping at its shrine are deceived thereby. Under intoxication the poor thinks he is rich; the weak thinks he is strong; the fool thinks he is wise, and one exposed to cold thinks he is remaining warm, when actually his temperature is subnormal. Alcohol positively lowers the temperature of the body by its benumbing influence upon the nervous system, thereby decreasing the excitability and action of the thermogenetic afferent nerves and centers.

The most conclusive evidence of the erroneous views which are held concerning the auxiliary effect of fatty matter and alcoholic stimulation in increasing heat production, is the experience of the arctic explorers. Explorers who have used alcoholic stimulants to assist in maintaining normal warmth, are lying amidst ice and snow in the arctic regions, hidden monuments of common ignorance concerning the effects of alcoholic stimulation.

The free use of fats has also proved to be detrimental to the health and welfare of Northern explorers, because of the digestive derangement that is engendered by their use. The use of free fat in any amount has not only proven to be unnecessary, but not as good as other nutritious diets not containing free fat, such as plain Graham crackers.

The free use of coffee is also detrimental to the user thereof, if he is to withstand much exposure to cold.

The use of milk, or any easily digested non-stimulating foodstuff not containing free fat, which furnishes nourishment to the nerves and all other tissues of the body, has proven to be the greatest mainstay to mankind in withstanding the rigors of the arctic regions.

The fact that alcoholic stimulation and the free use of fats have been abandoned by persons undergoing the strain of endurance, while surrounded by frigid temperature for weeks, is worthy of the consideration of persons who have been educated to depend upon the use of free fats and toxic stimulation to enable them to withstand cold, and is proof conclusive that they are not only unnecessary, but detrimental to persons necessarily exposed to a low temperature for any length of time.

V. Secretory.—Secretion is a process by which portions of the constituents of the blood are separated from the blood stream. This process takes place principally through the epithelial cells which conduct a flow through the walls of the capillary blood vessels. The purposes for which the secretions are used, are that of ferments for digestion; mucus for lubrication, and also serous secretion, as in the pleura and in the peritoneal cavities, and in the synovial membranes, as in the joints for the prevention of friction.

The process of secretion is aided by physical forces and by diffusion, osmosis, and filtration. We classify the secretions as external and internal.

1. External secretions are such as are used in the joints, mucous cavities, and alimentary tract, and in the eliminative processes of the body.

2. Internal secretions are those which are secreted principally by ductless glands, and are thrown directly into the contents of the blood vessel walls, and exercise

a decided influence upon certain physiological processes pertaining to the function of general metabolism.

The secretory organs are divided into two classes: Secreting membranes and secreting glands.

Internal secretions are productions which are a result of the activity of secreting glands, while the external secretions are the production of both classes of secreting glands, namely: Secreting membranes and secreting glands. We classify the secreting membranes into three divisions, as follows:

1. Serous.
2. Mucous.
3. Synovial.

Glandular secretion is from such organs as the following:

1. Liver.
2. Spleen.
3. Kidneys.
4. Pancreas.
5. Thyroid glands.
6. Pituitary glands.
7. Genital glands (testicles).

VI. Excretory.—Excretion is the process of elimination of the end products of tissue metabolism, and does not differ essentially in process from the action of secretion. The principal excretions of the body are urine, perspiration, bile, and carbon dioxide. The process of excretion, whether of the skin, liver, or kidneys, is wholly under the influence of the automatic or physiological control of nerve function.

The physiological influences originate in the central portion of the nervous system, and since the action of the abdominal brain, or sympathetic system, which controls the automatic action, is dependent upon vital impulses from the central nervous system, interference with spinal nerves which are the channels of distribution

of the central impulses, will derange the process of either secretion or excretion.

All function is the production of nerve impulse, and there can be no secretion or excretion except it be excited through nerve action. The major portion of the phenomena of nerve action is excited by afferent stimulation, and the work done by most of the efferent nerves is but a reflex result of the afferent impulse.

We smell food that is cooking. The afferent nerves of the air passages are stimulated thereby, and as the result of the reflex excitation of motor nerve endings, in the glandular secretory organs, our mouths will water. In this case the motor impulse which causes the glandular secretion of the saliva, is the result of peripheral stimulation of the afferent nerves of smell.

The presence of food in the stomach will reflexly excite secreto-motor impulses of the secreting glands which furnish the digestive fluids. The alkaline condition engendered in the mouth during mastication, acts as a special excitant to the afferent nerve endings of the stomach, and induce an acid secretion in the stomach which is necessary to the action of pepsin upon the food.

It is the fecal matter in the bowel which stimulates the afferent nerve endings in the walls thereof, which sets in action the reflex peristalsis and glandular secretions into the bowel contents.

When the bladder is filled, it is the presence and pressure of its contents upon the sensory terminal nerve endings in the bladder which excites the motor impulse favoring evacuation.

In childbirth the fetus becomes the exciting and stimulating element which induces the contraction of the uterus. The blood is an excitant in the blood vessel walls and cavities of the heart, which causes reflex contractions of the muscles of the heart walls.

Many of our thoughts and the condition of our mind,

and even the resulting physical condition of the body, are influenced by what we see and hear. It is wonderful when we study the phenomena of the mind, and the result of afferent impressions.

You may be sitting in your room quietly and hear the strain of some old familiar song; it will call you back to the days of childhood. You may remember some sweet voice in the days of yore, and a train of thoughts may rush in upon your mind and tears of joy and tears of regret may unbidden start as the result of that afferent impression made by the sound of the familiar strain through the special sense of hearing.

The function of the brain may be voluntary or involuntary. In voluntary action, the mind originates an impulse, which may cause muscular action. It may cause us to walk, to write, or to perform any duty. Such actions are not directly excited by afferent impulses, yet they may be the result of afferent impulses of previous occasions.

Voluntary action is considered as a result of our own desires and automatic production of impulse, and there may not be any connection between this voluntary action and afferent stimulation. Voluntary action is wholly of the cerebro-spinal system. It is wholly the production of the mental faculties. There can be no such thing as voluntary action in the abdominal brain.

The spinal cord is the great reflex center of the great nervous system. The spinal cord, together with the sympathetic system, contain and perform the automatic control, and the involuntary action which is ever present during life.

VII. Inhibition.—Inhibition is that function of the nervous system or of certain centers thereof, which controls the excitability and action of the nerves regulating the involuntary muscular action.

The function of inhibition may be so greatly increased

as to entirely suspend the action of the nerves, responsible for involuntary tissue action. The inhibitory action may be decreased by depression or paralysis of the inhibitory centers, and, as a result, reflex and involuntary action may be greatly increased.

If the nerves transmitting the inhibitory impulses are severed, we then experience an entire loss of inhibitory control of the involuntary muscles affected thereby.

We have lack of inhibitory control in chorea, St. Vitus dance, and in spasms, fits, and convulsions.

CHAPTER VII.

THE SYMPATHETIC SYSTEM.

THE functions of the sympathetic nervous system are an important study. That it is endowed with the power of functioning of its own accord, entirely independent of the action or influence of other portions of the nervous system, is no longer claimed by physiologists.

That the abdominal brain is a component part of the general nervous system, and that it is dependent upon the central nervous system for its power of action, is now generally conceded.

All the nerve tissues within an animal body are now almost invariably regarded as a single nervous system, and each component part of the nervous system is dependent upon other portions for its vitality and functional activity.

The phenomena of vital function in peripheral structures, which are supplied by the gray rami of the sympathetic system, will cease immediately after severance of the connection of the relative spinal nerves which contribute white rami communicantes to the sympathetic ganglia, from which the gray rami originate.

The ganglia of the sympathetic system may, and do, for a time, maintain their excitability and functional power after being isolated from other portions of the nervous system, provided conditions are favorable as to temperature, moisture, and nutrition.

We have many examples demonstrating the excitability and action of the automatic ganglia of the nervous system after the viscera are removed from all spinal connections.

The automatic function of reflex action that is normal

during the intact of the entire nervous system, is for a time manifest, and acts in the same way in certain isolated viscera for a limited time under favorable conditions. This is true in case of the terminal ganglion being within the tissues of the organ supplied.

It is the existence of such automatic action for a limited time that tends to establish beyond a doubt the fact that nerve action and response to stimulation is independent of any intelligence, mental action or function.

The functions of the sympathetic nervous system are as follows:

1. Motor.
2. Trophic.
3. Secretory.
4. Excretory.
5. Inhibitory.
6. Vasodilator.
7. Vasoconstrictor.

Often the vasoconstrictor influence results as a primary effect of a stimulation, while the vasodilator influence results as a secondary effect of excessive stimulation.

The sympathetic system seems to possess independent functions in certain organs where the terminal ganglion is within the tissues of the organs supplied. We have examples of this in the case of ganglia of the

1. Heart.
2. Stomach.
3. Oviducts.
4. Mesentery.
5. Lymphatics.
6. Vas deferens.
7. Uterine walls.

Functional action in the parts or organs supplied by the terminal cellular tissues of the sympathetic, are manifest for a time after severance of the spinal connec-

tion, yet their action at all times is influenced by the white rami from the spinal nerves. The terminal automatic ganglia above mentioned, are partly inhibited and stimulated through afferent fibers from the spinal nerves and their effects on the efferent nerves.

The more dependent cellular tissues of the sympathetic system depend almost wholly upon their connection with the cerebro-spinal system for their power of functioning, and all the excitability and functional activity of these ganglia stop, very soon after being severed from their connection with the spine. We have examples of this connection with spinal nerves in the formation of the splanchnic nerves. The three splanchnic nerves receive fibers of white rami communicantes from the fifth and twelfth thoracic nerves inclusive, and are partly made up from fibers from the relative ganglia of the gangliated cords of the sympathetic.

Functional activity of the fibers of this portion of the sympathetic system, seems to be the result of impulses given off by the spinal nerves, which are taken up by the sympathetic cell, around which the white rami arborize, and is conveyed from thence by means of gray rami to the zone of action.

Function of the Cervical Portion.—Some study has been made of the function of the cervical portion of the gangliated cords by the use of stimulants and by notation of the effect or action produced in the organs supplied.

The induced electric current used to stimulate the central portion of the superior cervical ganglia, will induce phenomena such as dilatation of the pupils of the eye; contraction of the nictitating membranes of the eye; also contraction of the blood vessels of the skin and of the mucous membrane; contraction of the nutritient vessels of the salivary glands; contraction of the pilo-

motor muscles, causing erection of the hair of the head, etc.

If the gangliated cord is divided, then the opposite phenomena are induced. If, then, the cut end is stimulated, we will have a reappearance of the former phenomena.

The rami communicantes from the spinal nerves that ramify and affect the superior cervical ganglia, are given off from the first to the fifth thoracic segments of the spinal cord or from the corresponding nerves therefrom.

The superior cervical ganglia are the transfer or substations of the sympathetic for the two upper streams of white rami communicantes from the upper thoracic segments of the spinal cord. They terminate in the superior cervical ganglia, and arborize around the cell structures thereof.

The connection existing between the upper spinal nerves and the superior cervical ganglia is by means of the white rami which join the gangliated cords, and many of these fibers pass unchanged, upward in the cords and into the superior cervical ganglia, where they terminate by arborization, and where all impulses are transferred to and communicated by way of the sympathetic gray fibers to the terminal ganglia and to the cranial nerves.

FUNCTION OF THORACIC PORTION.

FUNCTION of Thoracic Portion.—The thoracic portions of the gangliated cords receive their white rami from the relative thoracic nerves. The cervical ganglia, and the ganglia of the pelvic region likewise receive their white rami from the thoracic nerves principally, by way of the two streams of the white rami communicantes.

For this reason there is a similarity between the functions of the cervical, abdominal and thoracic portions of the gangliated cords of the sympathetic. How-

ever, the function of the cervical ganglia, more especially the superior cervical, would simulate the functions of the thoracic portion, while the pelvic functions would simulate those generated by the abdominal portion.

This is owing to the fact that the thoracic white rami joining the thoracic ganglia, are from the same source as are the white rami that join the superior cervical; and another reason for the similarity of the functions of the cervical and thoracic portions of the gangliated cords, is the fact that the ganglia given off from the superior thoracic portions of the gangliated cords, are partly formed by branches coming from the superior, middle, and inferior ganglia of the cervical region. Hence, organs supplied by the cardiac plexus receive impulses by way of both the cervical and the thoracic portion of the gangliated cords.

In the abdominal and pelvic region we have a similar condition because of the fact that the white rami of the lower thoracic region join both the solar plexus and the pelvic plexus.

Another reason for the similarity of the functions of the abdominal portion of the cord and that of the lumbar and sacral, is that terminal branches of the pneumogastric nerve communicate with rami of spinal nerves in the formation of both the solar and the pelvic plexuses.

By means of the afferent fibers of the pneumogastric, impulses are carried in a centripetal direction, and affect the efferent fibers and function of the pneumogastric. Impulses are carried in a centripetal direction, and affect the integrity of the function of this nerve, and in this way reflexly affect the heart and stomach. The pneumogastric from above is joined by gray rami from the superior cervical ganglia, and in this way we have an influence through the pneumogastric upon the heart, lungs, stomach, and abdominal organs.

There is a variation in the function of the different

segments of the thoracic and abdominal sections of the spinal cord, and the phenomena produced by stimulation varies in different parts.

The stimulation of spinal centers will excite and influence the action on the part of the spinal nerves, and also upon the part of the relative ganglia of the sympathetic cords. This fact is of special interest in spinal treatment. Different centers in the cord excite a different action upon the viscera, both by acting directly upon the terminal ganglia, and by communicating through the ganglia of the sympathetic cords. We may cause vasoconstrictor influences by stimulation of one center of the spinal cord, and may cause vasodilator influences by stimulation of other segments of the spinal cord.

Any one doing spinal treatment may greatly increase the potency thereof by having a thorough knowledge of the influence of the different spinal centers upon the different viscera they desire to affect. This subject will be brought out more fully under the head of Spinal Centers in a subsequent chapter.

There is one fact that is well to remember, and that is, that in the stimulation of nerve impulse or function of nerves, there is always a primary and a secondary effect in which the phenomena produced are quite different.

The primary effect of the stimulation of the thoracic ganglia is that of inhibition and vasoconstriction, while the secondary effect is that of vasodilation and general hypo-tonicity. For the above reason we may excite vasoconstriction or vasodilation, and we may also incite viscero-motor or viscero-inhibitory action by a stimulation of the ganglia of the thoracic portions of the sympathetic cords, which may be done indirectly by a stimulation of the relative spinal segments.

FUNCTION OF THE PELVIC PORTION.

FUNCTIONS of the pelvic division of the gangliated cords are similar to that of the abdominal and thoracic divisions. One fact should always be borne in mind in this connection, and that is, that in the pelvic or abdominal region, stimulation of the spinal centers is inclined to cause vasoconstriction of the blood vessels of the viscera above, and to produce vasomotor action of the organs and extremities below.

REFLEX ACTION.

The word "reflex" means to fly back. By reflex action we refer to that phenomena of nerve action in which impulses are carried in both directions, both centripetal and centrifugal.

The "reflex arc" consists of an afferent tract, reflex center and efferent conduction path of a nerve impulse, which is incited as a result of peripheral excitation of afferent nerves.

The study of the subject of reflex action is the most important consideration in the study of etiology of disease, as well as functional activity that depends upon involuntary action of the nervous system, as spinal lesions are because of spinal contractions, and deranged function is because of disturbance of the excitability of nerves, or of the condition of the reflex cycle. The reflex phenomena and derangements thereof, are directly responsible for certain forms of maladies, while the normal inhibition and the normal reflexes are responsible for normal functioning.

There are three varieties of reflex movements that are recognized:

I. Simple, or partial reflex.
II. Extensive co-ordinate reflex.
III. Extensive inco-ordinate reflex.

I. The Simple, or Partial Reflex.—This is when the path of the nerve impulse is confined to the normal afferent tract and its normal reflex center in the gray matter of the cord, and is given off to the corresponding efferent fibers affecting one muscle or a certain group of muscles.

The extensive reflex, either co-ordinate or inco-ordinate, is a phenomena in which the afferent impulse is transmitted from one reflex center in the spinal cord to another, exciting numerous centers and sending out impulses over many nerves and exciting the movements of a great portion or of the entire body which is due to an irritable condition of the spinal centers.

Every sensory root has its individual spinal center and a special reflex path, which offers the least resistance to the transition of an afferent impulse, and for this reason the tendency is that the afferent impulse is transmitted and sent back by a corresponding efferent nerve.

Normally there is more or less resistance against an impulse being transmitted from one special center in the gray matter of the cord, to others, and this normal resistance against impulses from one reflex path, being transmitted to adjacent and remote segments, accounts for the fact that normal reflex is a simple or partial, and the most common phenomenon of reflex action.

In nature, certain afferent impulses, because of training, send impulses back over other nerves. In such cases there must be a transfer of the afferent impulse to other centers of transition than its own. After sufficient training the passing of the impulse from one reflex center to another, seems to become a habit, and the transmitted reflex action becomes the usual result of the afferent impulse.

The transition of impulses from one center to another in the gray matter of the spinal cord, depends upon the excitability of the cell tissues of the spinal cord. There

are certain medicines that will reduce the excitability of the cellular tissues of the gray matter of the spinal column, and there are other remedies that will increase the excitability of these same centers, and the ability to produce a sedative effect upon the spinal centers by medication has led to the use of these drugs in the treatment of certain diseases characterized by an over-excitability of the spinal centers.

The primary effect of anæmia upon the spinal cord is to produce an excitable condition of the spinal segments, while the secondary effect of absolute anæmia will deprive them of any excitability or capability of response to stimulation. The transfer of impulses from one center to another depends wholly upon the excitability of the reflex centers in the gray matter of the cord. The more excitable these centers become, the more readily are they affected by diffusion of an impulse from one reflex center to adjacent and remote centers.

II. Co-ordinated Reflex Action.—When an impulse reaches a spinal center and is transmitted to other centers producing an action along normal lines in harmony with previous training and previous trained action, we have what is known as a co-ordinate reflex action. Such an action is manifested without any intelligence, and even after the reflex centers have been severed from the brain and mental centers.

A decapitated frog will jump when excited by a local irritation. In such case reflex phenomena has occurred. The local excitation has created an afferent impulse that has been transmitted to the centers controlling the motor action of the extremities. During the life of this animal local irritation has caused a general movement of the body out of danger, and this reflex, which seems extraordinary, is but the result of lifelong training.

Whenever we have a reflex that is conducted along the spine from one center to another which produces

action that occurs normally in nature, it is called an extensive reflex, but at the same time the phenomena is in perfect control and co-ordination, therefore denominated a co-ordinate reflex action. We see that manifested in life in many ways. The act of walking, running, jumping, playing the piano, writing on the typewriter, and in fact in almost all occupations of life, we have a trained co-ordinative reflex action in proportion to the skill that is possessed by the operator.

III. Inco-ordinated Reflex Action.—Inco-ordinate reflex is like the co-ordinate, in one respect, because of the extension of an impulse from one center in the spinal reflex tissues to another, but is different entirely as to the nature of the work done as a result of the afferent impulses.

When an impulse reaches a center, and because of an over-excitability of adjacent and remote centers it is diffused from one center to another throughout the entire reflex nervous centers, and when action is produced at random without inhibition or control, we have what is known as an inco-ordinated reflex action.

We see manifested such a phenomenon in tonic and clonic contractions, in convulsions, in spasms, and different forms of fits. An understanding of the inco-ordinate reflex action furnishes the solution of the philosophy of the phenomena witnessed in many such cases as enumerated above, and we can conceive of no other solution of the cause of such phenomena than that of diffusion of nerve impulse from one reflex center to another, producing inco-ordinate reflex action.

The source of the afferent excitation that is most likely to produce inco-ordinate reflex-spasms and convulsions—is the afferent terminal fibers of the alimentary canal. Afferent excitation of the spinal reflex centers in children from the alimentary canal is more apt to cause an inco-ordinate reflex action, than like afferent stimuli

in older people; hence, children are more subject to spasms and convulsions from excitation of the stomach and bowels than are grown people. The stomach disturbance will often cause convulsions, while parasites in the alimentary canal will sometimes render children subject to fits or spasms.

The author was, while visiting a doctor's office in St. Louis, asked to give an opinion as to the cause of a more or less chronic spasmodic condition of almost the whole body of a child which was about seven years of age. After due consideration, we gave our opinion of the etiology of the case as follows:

That the child was suffering from alimentary irritation and excitation, which was causing an extensive inco-ordinated reflex action of the reflex centers of the spinal cord because of diffusion of the afferent impulses. The author advised that a microscopic examination be made of the bowel contents to determine if there were present any ovum or other evidences of abdominal parasites, and if the results were negative in this test that the child should be put on a fast for a few days to determine if the food was the excitant stimulus of the afferent impulses causing the inco-ordinate reflex phenomena. Pursuant to our advice, a thorough examination of the fecal matter was made, and ovum of lumbricoids were found to be abundant.

There are some persons possessed of a pathological condition of the reflex centers of the cord, and such are prone to fits and spasms. One reason why our medicines are not effective against the phenomena of spasms and fits, is because the effects of them are only transient.

There is a mechanism within the nervous system by means of which the production of reflex can be suppressed, or controlled, and which has been designated as inhibition of reflex. Through the action of the will and the control of the mind over nerve function, certain reflexes

may be diminished or prohibited, but it is only within a certain limit of the amount of excitation that mental control can prohibit reflex action.

Reflex action, primarily, is entirely independent of the will. There are certain centers within the cerebral apparatus in lower animals—and no doubt the same is true in man—that have a controlling influence over reflex action.

REFLEX ACTION AND SPINAL LESIONS.

There is another phase of the phenomena of reflex action that, to the mind of the author, is the most important for consideration of any connected with these phenomena. As stated above, the reflex cycle consists of an afferent and efferent impulse with a transfer of impulse intervening between them. In order to have the afferent and efferent impulse and reflex act, it is necessary to have the following nerve mechanism:

1. The afferent nerve tract, together with the peripheral arrangement for the reception of impulse.

2. We must have the reflex center or path in the gray substance of the cord which acts as a transfer station, transferring the afferent excitation or impulse to the efferent tract.

3. We must have the efferent tract carrying the impulse centrifugally to the peripheral end of the motor efferent nerve to the tissues supplied.

It is also necessary to have an excitant or stimulant to excite the afferent impulse which passes over the reflex cycle. The afferent nerve is prepared for the reception of excitation of impulse at its peripheral ending, the impulse being conducted throughout the entire length of the afferent nerve until it reaches the transfer station in the reflex center of the spinal cord. Then the impulse must travel over the entire length of the efferent nerve

from the transfer or reflex station in the spinal segments to the peripheral nerve endings. The entire motor nerve, from center to periphery, is thrown into a state of action. All the branches of this nerve partake of that same excitation, being affected by the same impulse.

In the peripheral ending of the motor efferent nerve, the work done depends upon the nature of the tissues that are supplied. The same is true of all the branches given off from this motor efferent nerve which of necessity must become excited in the reflex act. The reflex impulse reaches the first branches from the efferent nerve first, and therefore the first action is produced in the tissues supplied by that branch.

The primary posterior division of all spinal nerves ramifies the musculature of the spine of the relative segment to its origin; consequently all reflex impulses exciting a motor response, will influence and affect the musculature of the spine. For further consideration of this point, we refer the reader to the chapter upon the Cause of Spinal Lesions.

PART TWO.

INTERFERENCE WITH NERVE FUNCTION.

CHAPTER I.

INTERFERENCE WITH NERVE FUNCTION.

SINCE disease is essentially the phenomenon of deranged function, and since, during life, nerves function normally when they are not interfered with in any way, the study of the subject of interference with nerve function becomes at once one of the most important studies pertaining to etiological agencies.

Nerve function is important from two considerations: First, normal auto-protection depends upon normal vital activity, which is the result of nerve impulse; therefore, nerve interference becomes a predisposing cause of infectious and contagious disease.

Interference with nerve impulse is the cause of deranged function, and therefore becomes the cause of the continuation of disease; or, secondarily, the cause of the continuation of all chronic diseases.

A thorough understanding of the manner in which nerves may be interfered with, is most important from a prophylactic standpoint. Normal nerve supply to normal tissues will impart or generate therein normal function or health, while interference with nerve supply will cause deranged function, or disease. The principal causes of interference with nerve function may be enumerated under the following:

I. Malnutrition.
II. Nerve stimulants.
III. Nerve depressants.
IV. Mental impressions.
V. Structural lesions.

VI. Traumatic alterations.

VII. Mechanical interference.

In the above enumerations we have embraced the principal agencies that will increase or decrease, or in any way alter the normal nerve impulse and consequently derange the function in the zones supplied.

I. Malnutrition.—The nutrition of nerves is necessary to their excitability and conductive power. It is proved by physiological experiments, that, by diminishing the arterial supply to a nerve, almost immediate effects are produced diminishing the nerve's action. If an artery supplying the nourishment to any nerve or set of nerves is tied, the excitability of the nerve or nerves, so deprived of nourishment, will be lost. If the ligature is removed from the artery, and if the circulation and nourishment to the nerve is renewed, we have a restoration of their excitability and conducting power. This same physiological fact can be demonstrated by pressure upon nerves. If the pressure occludes the arterial supply to any nerve or nerves, their excitability and power of transmitting impulse will be diminished or entirely abolished from partial or complete occlusion of the nutrient supply.

If from any cause the brain becomes anæmic, the function of mental activity is abolished. If pressure of sufficient force is made upon the abdominal artery of a rabbit, the hind extremities of the animal will be completely paralyzed during continuation of the occlusion.

In the study of malnutrition of nerves, it is well to remember that nerves receive their nourishment through their cellular portion at the point of the origin of the nerve fiber. From this fact we must appreciate that it is interference with the nutrition of the central nervous system that has the most potent effect upon the function of nerves.

Since all nerves originate within the brain and spinal

cord, except those nerve fibers originating from the sympathetic ganglia which receive their impulses from the cerebro-spinal nerves, it is therefore an interference with the circulation and nutrition within the brain and spinal cord, which is responsible for the disturbance that comes from cutting off the nutrition.

Any spinal lesion which will interfere with the intervertebral foramina, may cause interference with the nutrition of the segment of the cord, giving off the nerves which pass from it. This is due to the fact that we have contained in the sheath of the spinal nerves, the blood vessels and lymphatics, which convey the nutrition to the spinal cord.

The only rational way to remove the cause of interference with the nourishment of the spinal cord, is to relieve the interference with the neural sheath containing its nutrient supply and drainage. In this connection it might be well to consider another phase, namely, that of fasting and starvation.

When man, or any other warm-blooded animal, is deprived of all food, nature will decompose and utilize the kinetic and potential energy stored in its own tissues, and in this way will generate bodily heat and energy to perform mechanical labor. The waste products of muscular tissues during exercise will greatly decrease the amount of matter within the body, until death from starvation occurs. The cutting off of nourishment from a patient will reduce the bodily weight in proportion to the excessive amount upon the body of the patient, and also in proportion to the amount of physical exercise that is taken.

The writer had one patient under his observation who made a phenomenal fast which stands as a world's record, in which the loss of weight was very small considering the length of the fast. The patient was Dr. C. B. Williams, of Santa Cruz, Cal., who underwent a fast of

seventy days, and during that time ate thirteen oranges and fifty cents' worth of fruit. The actual loss in weight during the seventy days was only twenty-nine pounds.

There is another consideration to which we wish to call your attention in this connection, and that is, that during a fast there is not that loss of strength which we would expect; in fact, it is claimed that the deterioration in strength during a short fast is not only *nil*, but there is an actual increase in endurance, if not in strength. This is proved by tests made at different times.

The writer, to test this matter, went seven days without food, and took no nourishment of any nature whatever, and no liquid save drinking water; walked from four to eight miles each day; took a Turkish bath and sweat, and an enema each forenoon during the entire fast. As a result of the absence of food, we felt no weakness, and were troubled very little with the sensation of hunger, but did not wholly lose an appetite. The principal difference noticed was that there was an absence of muscle tire after continued exertion, and no brain fag following lectures or mental work for hours at a time.

During the week the writer was delivering from two and a half to three hours' lectures each day, and could lecture for two hours without feeling exhausted or tired in the least; in fact, felt like going on instead of stopping. After walking two or three miles, was indifferent as to sitting down and resting, while, before this, when eating regularly, a walk of one mile would cause a sense of fatigue and a desire to rest. The loss of weight, owing to the bathing and excessive exercise, was heavy, being twenty pounds in seven days.

After this experience we were prepared to believe and to appreciate the records made in New York by Prof. Gilman Low. World's records in strength and endurance have been accomplished after a fast of a week's time. Feats of strength have been performed by people after

a fast of from one to several weeks, that could not be accomplished by the same person while upon full rations. We copy from the work of Irving J. Eales, Belleville, Ill., a record of tests in his valuable book, entitled Healthology:

"Eight athletes were entered on the list on Saturday night at the beginning of the fast, and the same eight athletes presented themselves at the final contests of endurance on the evening of the seventh day of the fast. The records made by them are now world renowned. Mr. Joseph H. Woltering, of New York City, was awarded the first prize in races. He won the fifty yard dash in six and two-fifths seconds; the 220 yard run in twenty-seven and four-fifths seconds, and the mile run in six minutes, fourteen and two-fifths seconds. Mr. Gilman Low, of New York City, the well-known artist, health director and athlete, won first prize in strength contests. Mr. Low lifted 900 pounds in a straight hand grip lift, and the 56-pound weight was thrown thirteen feet, six inches. Mr. Low, to prove that his strength had not deteriorated a particle, lifted, on the sixth day, with hands alone, 500 pounds twenty times in fifteen seconds, and 900 pounds twice in twenty seconds. With back lift, one ton, twelve times in twenty seconds. After the tests, on Saturday night, he lifted one ton twenty-two times in nineteen seconds, before a group of doctors, in order to demonstrate to them what he knew to be true in regard to fasting. Remember, these are now world's records in strength and endurance, and were made after seven days without food. Mr. Low broke his fast at Madison Square Garden after the other athletes broke their fast, and at the end of eight days, before 16,000 people, established nine world records in strength and endurance, which have since remained world records, no one having been able to lower them, and these were made in competition with other men who had been eating

regularly, and he was going out of his class to do it. These nine world records are as follows, viz.:

1. Raising 950 pounds three times in four seconds.
2. Raising 500 pounds twenty times in fifteen seconds.
3. Throwing 56-pound weight thirteen feet, six inches (for height).
4. Leg lifting—raising with legs alone, 1,000 pounds fifty times in twenty-five seconds.
5. Leg lifting—raising with legs alone, 1,500 pounds thirty-five times in thirty-five seconds.
6. Raising with legs alone, 1,800 pounds eighteen times in eighteen seconds.
7. Back lifting—bringing all the muscles of the back into action—raising 2,500 pounds five times in ten seconds.
8. Raising 2,200 pounds twelve times in twelve seconds.
9. Raising 2,000 pounds twenty-nine times in twenty seconds.

Mr. Low has other world records, after fasting, made at other times, and he established the phenomenal record of lifting one million, six thousand pounds, in thirty-five minutes and thirty-four seconds. Immediately following this lift, he raised one ton forty-four times in four minutes. The lift was accomplished by lifting 1,000 pounds 1,006 times in the time specified, the only man living in the history of the world who ever accomplished such a feat. And this feat was accomplished after two months of training on what would be termed a starvation diet. The diet was as follows (I quote from a letter from Mr. Low to the author, dated July 2, 1907):

"My diet during my training for the million pound lift, was as follows: The first five weeks, one meal daily, consisting of three eggs soft-boiled or uncooked—more times uncooked; fruit, as oranges, grapes, apples or bananas; cereal and nuts, and one glass of milk after

each meal. Plenty of cool, distilled water during the day. As an experiment, I ate meat twice during the first five weeks, and I found I could have done just as well without it. The last three weeks I lived on four meals weekly, consisting of the same diet as the five weeks previous. At ten o'clock on the morning of the day that I made the lift, I increased the eggs to six, also somewhat increased the bread; otherwise the meal consisted of the same allowance. Nothing was eaten again until after the lift was made, which was accomplished at nine o'clock in the evening, making a lapse of eleven hours between the last meal and the lift. That which followed is already history. It might be well to note that I lost during the thirty-five minutes and thirty-four seconds, five and three-quarter pounds; fifteen minutes later I lifted one ton forty-four times in four minutes."

Mr. Low had previously attempted this feat and utterly failed, reaching only a little over the half million mark in twenty-five minutes. Then he ended in sore distress and dizziness. He had been eating two meals daily. Mr. Low says freedom of lung power is very important in lifting, for as one ceases to breathe well, the muscular power fails. He believes in cutting down the food and practicing deep breathing. He is a model of physical perfection as shown by his measurements, obtained and perfected entirely through his methods, viz.:

Neck.............	17 in.	Hips............	39 in.
Chest, contracted.	37 in.	Thigh...........	26½ in.
Chest, normal....	45 in.	Knee............	14½ in.
Chest, expanded..	52 in.	Calf.............	16½ in.
Waist............	34 in.	Ankle............	9¼ in.
Biceps...........	16½ in.	Height.......	5 ft. 9¾ in.
Forearm.........	13 in.	Weight, stripped..	187 lbs.

Dr. Eales says that:

"In a letter to Prof. Gilman Low, shortly after my fast in July, 1907, I called his attention to my strength

tests, and to the fact that there was no impairment of strength after my long fast, asking him what his experience was in regard to his strength after a fast. I also informed him that a number of the doctors here had stated that it was impossible for one to go thirty-one days without food; that in one week a person would be so weak he could scarcely walk, and a few more days would endanger life. In answer to my letter, Prof. Low, among other things, writes as follows, in a letter dated July 29, 1907:

"'At the end of my fifteen-day fast some years ago in Boston, I could have thrashed my weight in wild cats. If the doctors you refer to in your letter, think a man will be so weak in a week's time he cannot walk, I will fast fifteen days and if any two of them can handle me (in any way suitable to them) I will give them each $100.00. In other words, immediately following a fifteen-day complete fast on my part, I will be willing to place myself in a room of their own choosing, dressed the same as they and empty-handed absolutely. Then send in any two of these doctors to drive me out (or perhaps they think I would be so weak they would have to carry me out) and if they succeed in driving me out, or ridding the room, they are privileged to kick, scratch or bite, then they can each have $100.00. If I put them out, which would surely be the case, no matter how big they are, then they are to give me $100.00 between them. Is this fair, Doctor? It would then be laughter and applause on my part. Very truly yours, GILMAN LOW.'"

Some of the causes of interference with the nutrition of nerves may be enumerated under the following headings, namely:

1. Overfeeding.
2. Underfeeding.
3. Poor digestion.
4. Poisonous food.

5. Poor assimilation.
6. Occlusion of circulation.
7. Impingement of gray rami.

Any of the above causes will sooner or later cause an alteration of the amount or quality of the nutrient supply, and any alteration of the character of the nutrient supply will be more baneful in effects than a mere deficiency of nutrition, especially if the nutrition in any way become toxic in character either from the nature of the food or from changes taking place causing the development of toxic elements.

CHAPTER II.

NERVE STIMULI.

ANY agency that acts as an excitant or stimulus to a nerve, will alter and derange the functions thereof, and nerve function may be altered in two ways:

1. Nerve stimuli will increase the excitability and transmitting power of nerves, but the effect may be transient.

2. Nerve stimulation, after being excessive, or employed for a sufficient length of time, will produce the opposite effect, and thus decrease the nerve's excitability and power of conductivity.

By nerve stimulant we mean any agency or material or any condition that will excite a nerve. The action of a nerve stimulus is similar in effect to the action of a goad when applied to a tired horse. Nerve stimuli excite an expenditure of the reserve nerve energy, but does not add to the amount of nerve energy in any way.

The effect of a nerve stimulus depends upon the property possessed by the nerve enabling it to be thrown into a state of excitability. We enumerate below some of the more common nerve stimuli under the following heads:

I. Toxins.
II. Medicine.
III. Chemicals.
IV. Electricity.
V. Mechanical action.
VI. Physiological action.
VII. Extremes of temperature.

Any of the above will act as nerve stimuli, but the action of each depends upon the amount and condition of their application. Some of the nerve stimuli may also

act as nerve depressants because of the depressing influence upon the functional activity of nerves, as the result of an excessive or long continued excitation.

I. Toxins.—Under the head of toxins we refer to those which are produced by the action and development of bacteria, and more especially to those toxins produced by pathogenic bacteria within the human body.

The action of toxins produced by germs has a decided effect upon the thermo-genetic action of the nervous system, and therefore toxins become the cause of the elevation of temperature in the majority of febrile conditions. There is no other toxic element with which we are acquainted that has such a decided action upon the heat production, as do those of pathogenic bacterial origin.

Germs of themselves are harmless in the human body, that is from the standpoint of their existence and presence, but as a result of their incubation we have toxins produced, and it is the production of their development that is responsible for the exciting or stimulating action upon the thermic nervous mechanism. In all cases of toxic conditions and resultant fevers accruing frm boy-products of pathogenic infection, the results are manifested only after the incubation period.

TOXINS FROM OTHER SOURCES.

As the result of the failure of the action of the skin, as in hysteria or in sunstroke, we have auto-intoxication. If the skin is varnished, the retention of the toxic and effete matter that is no longer eliminated will produce a very rapid increase of heat production, and will soon produce fatal results.

We may also have an auto-intoxication from fermentation in the alimentary tract. This will likewise excite heat production. In local areas we may have ulcers, boils, carbuncles, and other pathological processes in

which we have pyogenic bacteria causing a local fever, and other symptoms of inflammation. If there is an absorption into the general circulation taking place from a local zone of bacterial action, we will then have general or constitutional symptoms, as the result of the absorption of toxins.

None of the nerve stimuli produce as powerful an excitation of the thermogenetic centers of the nervous system, as do the toxins of pathogenic bacteria; hence fever is readily produced in all cases as a result of the action of these toxins upon the thermogenetic centers of the nervous system.

II. Medicines.—Medicines are the most frequently used of the different nerve stimuli. This is due to the fact that medicine is relied upon almost wholly by the largest school in the practice of medicine. Medicine will excite nerves, and cause an increased action, and almost any part of the nervous system may be affected.

Practically all the functions of the nerves may be stimulated by the use of different medicines. For example, we may affect the vasomotor action of the nervous system generally, and in this way we may increase the action of the nerve supply upon the heart, the kidneys, the stomach, or almost any viscera or organ of the body.

Now the exciting action of medicine acts in two ways:

1. They may increase the excitability and transmitting power of the conducting fibers of the nervous system; or,

2. They may ultimately, because of excessive doses and excessive excitation, have a depressing effect upon the functional activity of the nervous system.

We must remember that when we, with medicine, excite or stimulate the action of the nerve supply beyond normal to any zone of the body, we are doing so by excitation. Therefore, the effects we get from medication are

temporary, lasting only as long as the excitation from the medicine, and for this reason chronic diseases cannot be cured by medication, but they may be for the time relieved by the temporary effects thereof.

In acute cases, medicine may accomplish something by virtue of its temporary effects, because nature may be able to make matters right by the time the transient effects of the medicine have ceased.

III. Chemical Stimuli.—Chemicals will excite nerves when of sufficient strength to cause alterations in the constituents of the latter within a limited degree of rapidity, and, like thermic stimuli, and practically all other stimuli, they first increase the irritability of the nerves, and then diminish their excitability to the point of abolition.

Chemical stimuli as a rule have less effect upon either sensory or afferent nerves than do thermic, but more especially is the effect upon nerves manifest from chemical stimuli, than from thermic stimuli.

Under the head of chemical stimuli we embrace both acids and alkalies, both of which have a positive action upon the nervous system, and produce an excitation of the nerves when applied. The result of the application of acids or alkalies to a nerve depends upon its strength. In physiological experiments we use applications of acids and alkalies to produce stimulation.

The cut ends of nerves may be stimulated by the application of a weak solution of acids or alkalies. If a nerve is cut, we note the cessation of the function which is produced by it. After the application of the nerve stimuli to the cut end, we have a reappearance of the functional phenomena, which is proof of the stimulating effect of the stimulus, and also gives us an insight into the action or function of the nerve upon which we are experimenting.

Acid tonics are used to stimulate the stomach action

sometimes; acid and alkalies are used as medicine because of their exciting or stimulating effect upon the sensory nerve and the consequent reflex action and motor activity.

IV. Electricity.—Electricity is the most positive, most powerful, and one of the most specific excitants or stimuli that we can apply to an individual brain center or to an individual nerve, where it may be prepared for the reception of stimulation.

The electric current exerts the strongest effect as a stimulus at the time of making and breaking the current. The irritating effect of the electric current is also enhanced at the time of a rapid increase or decrease of the current. If the electric current is gradually increased or decreased, it will produce less of an irritating effect. The more sudden the beginning or an increase of an electric current, the more marked is the resulting stimulation.

Nerve stimulation by means of electricity is transient in effect. After the cessation of the action of the stimulus, we have a depressed condition of the excitability and transmitting power of the nerves. If the electric stimulation is maintained for a considerable time, no doubt a good deal of work may be done by glands that have been partially inactive. As a result of overwork because of excitation, some relief from the conditions that exist may be experienced.

This temporary relief may cause a patient to feel that he has been benefited by an electric treatment, but no doubt in the great majority of cases the beneficial effect is but transient. It is for the above reasons that electric stimulation does not effect more cures; however, electricity may do some good in certain cases if properly applied, for the reason that it may affect the metabolic processes and increase growth and development in the early stage of animal life.

V. Mechanical Action.—Mechanical stimuli will affect nerve action when they induce a change in the nerve particles within a certain degree of rapidity.

The subject of mechanical interference is one of vastly more importance than it is at first considered. It is a well recognized fact that the following agencies will act as mechanical stimuli when the application is of sufficient degree of intensity:

1. Blow.
2. Section.
3. Traction.
4. Pressure.
5. Puncture.
6. Crushing.
7. Percussion.

The most frequent point of mechanical interference with the normal nerve function is where the nerves make their exit from the neural canal through the foramina formed by notches in the adjacent pedicles of vertebræ. This is due to the contractibility of the musculature of the spine. Spinal tissues contract the same as tissues of any kind in any part of the body. This subject will be considered more fully under the heading of Spinal Lesions.

We have a much more frequent agency of mechanical irritation used in practice affecting nerves than any of the above enumeration, as follows:

Mechanical excitation and stimulation of the roots of the spinal nerves may be excited by percussion over certain spinal centers. If we are thoroughly acquainted with the spinal centers and their action upon the organs which they supply, we are enabled to cause a vasoconstriction or vasodilation of the vascular system and of the tissues of the viscera of the thoracic, abdominal, and pelvic cavities. In this way mechanical stimulation induced by percussion may be used as a very potent

remedial agency in the treatment of functional disorders of the viscera.

VI. Physiological Action.—The nature of the physiological nerve stimulus is not understood, but we know something of the phenomena produced.

The physiological nerve impulses emanate or originate in the central nervous system in the brain or spinal cord. They pass at frequent intervals over the efferent nerve routes to their peripheral endings, and in this way the automatic performance of nerve function is maintained. The physiological impulses are in life forces continually at work.

The afferent stimulation from the normal physiological excitation, will also fall in this division, and we have examples of this in the circulation of the blood and in the phenomena of digestion and assimilation. The physiological impulses are generated and pass at all times during life from the nerve centers, and it is claimed by physiologists that we have from seven to ten waves of impulses per second generated within and emanating from the centers of the nervous system.

That we may have the normal transmission of the physiological impulses from the nerve centers, there must be a normal condition of the nerves over which the impulse travels, and freedom from any mechanical interference.

VII. Extremes of Temperature.—The application of either extreme cold or heat will excite nerve action by stimulation of the afferent nerve endings in proportion to the extreme of the temperature and the duration of the application. Cold applied to the surface of the body for a short space of time will excite the afferent nerve endings and produce a vasodilator effect upon the peripheral vascular system and a reaction against the cold.

The effect of a continued application is quite different from that of a brief application. The secondary effect

of the application of cold is to depress the sensibility and excitability of the afferent nerve endings. The ultimate effect of the cold application is paralysis. The ice pack applied to the head of a patient day after day will produce fatal results in practically every case. Too long an application of the ice to the head undoubtedly is a great mistake, and one that is too often made. The centers of the wonderful mechanism of the nervous system are paralyzed by the continued application of cold; consequently the function throughout the body is suspended.

Heat has ultimately the same effect as cold, when the application is extreme for a sufficient length of time. The primary effect of heat is vasodilation, but the continued application causes vasoconstriction. Heat acts as a nerve stimulant according to the extreme of the application. The lighter applications of heat will produce a longer period of stimulation, while the more severe applications will produce a more intense excitation, but the period of duration is less.

CHAPTER III.

NERVE DEPRESSANTS.

WE enumerate a list of the more common agents that may interfere with nerve conductivity, as follows:

1. Narcotics.
2. Anæsthesia.
3. Compression.
4. Lack of oxygen.
5. Cold application.
6. Lack of nutrition.
7. Galvanism (polarizing current).

This enumeration embraces agencies that have a depressing effect upon the conductivity of nerves, and from this standpoint we will consider them briefly:

1. Narcosis.—Narcotics benumb or deaden the excitability and transmitting power of the afferent or sensory nerves. Narcosis may be produced by the use of drugs, and this is done in the practice of medicine for the relief of pain in many cases. Narcotics in small doses or in weakened solutions, primarily act as nerve stimuli, but the secondary effect will lessen the excitability and sensibility of nerves. Full doses of narcotics quickly benumb, deaden and destroy, and if the effects become general, we may have unconsciousness, sleep or coma.

Narcotics depress the conductivity of nerves and lessen their capability of being stimulated to action, by decreasing their excitability. When a nerve loses its excitability as the result of a narcotic, ordinary afferent stimulation fails to excite an impulse, and should an impulse be excited, it would not be transmitted owing to the lowered condition of the nerve's power of conductivity.

Different drugs are used as narcotics. Among those

most commonly used, we might mention alcohol, opium, tobacco, chloral, hyoscyamus, cannabis indica, and a number of coal tar derivatives. The latter are now being manufactured and used quite extensively by medical practitioners.

2. ANÆSTHESIA.—Anæsthetics produce a condition of partial or total insensibility of the sense of touch or feeling. Local anæsthesia affects a limited or restricted area and is used in local minor surgical operations, while a general anæsthesia affects the sensibility of the entire nervous system and is used in major surgical operations.

Anæsthetics produce their effects by paralysis of the sensory nerves, thereby decreasing their excitability and power of transmission or conduction of nerve impulse. Chloroform and ether have long been used as the principal anæsthetics by surgeons.

Anæsthesia is a blessing to the patient who would undergo a surgical operation, not only because it destroys the sensibility of the nerves to pain, but further, because it prevents the reflex contractions of the spine that would be the natural consequence of the irritation of the surgeon's knife and disinfectants and other irritative processes of the operation.

An afferent nerve which is robbed of its excitability and transmitting power, will not transmit an impulse to the reflex center of that nerve, and consequently does not excite the motor nerve and the spinal contraction which would occur, were the nerves in a normal condition as to excitability and transmitting power.

3. COMPRESSION.—Compression depresses the conductivity of nerves when the compression is of sufficient extent to interfere with the cellular structure thereof. Impingement will alter the conductivity of both afferent and efferent nerves. The effects vary according to the amount of pressure, and the consequent disturbance of the cellular structures of the nerves.

Slight impingement will produce an inflammatory, and consequently a hyperæsthetic condition of the sensory nerves, which will increase the excitability and power of transmission or conductivity. Therefore slight impingement would come under the head of nerve excitants or stimulants.

The primary and secondary effects of slight impingement vary. If a slight impingement is long continued, the secondary effect may induce the opposite condition or result; that is, the secondary effect of slight impingement may depress the conductivity and power of transmission of nerve impulse. Increased pressure upon nerves excites them more intensely, but the state of excitement is more transient, and the sooner and more complete is the nerve action depressed.

Every impingement or pressure upon nerves will cause intense pain, and in extreme cases will soon produce the secondary effect, which is that of complete paralysis. Mechanical interference with nerves, then, may produce either of two effects: Inflammatory, excitable or increased action, or a depressed, benumbed and paralyzed condition of the nervous system—either condition will alter the function thereof.

4. Lack of Oxygen.—In a case of suffocation by gas, death is due to the cutting off or deprivation of the necessary amount of oxygen. Patients in advanced stages of typhus and other wasting diseases, suffer from the lack of aeration of the lungs, but the distress that is produced thereby, may be quickly overcome by the use of free oxygen. Thus we see that oxygen is necessary to the sustenance of vitality and action of the nervous system.

In the physiological laboratories of nature, oxygen is a very necessary element in the process of metabolism. It combines with the necessary elements of nutrition, and aids in the sustenance and the processes of cellular action. Oxygen, while combining with the necessary

elements, liberates or sets free the by-products resulting from muscular action, or tissue activity, and also combines with waste elements associated with the food substances. Cutting off the oxygen supply soon produces a paralytic effect, or complete paralysis.

We can live for weeks without food, but suffocation will soon occur without oxygen. An interesting example of the exhilarating effects of oxygen and water is illustrated by Dr. H. S. Tanner during his fast in the city of New York. During the first fourteen days of the fast Dr. Tanner took no nourishment and drank no water, and as a result he lost strength to a considerable extent. On the fourteenth day he visited the park and drank freely of soft water, and when he returned to the hotel he felt invigorated and strengthened, and went upstairs two steps at a time.

On the seventeenth day, after he had been using water for three consecutive days, he remarked to a medical student, that water and oxygen were two great nerve tonics. The medical student responded: "Oxygen and water may do for you all right, but for my part, I prefer beefsteak as a nerve tonic." Dr. Tanner suggested that they try a little feat of endurance to see which was more effective as a nerve tonic—meat, or oxygen and water.

They ran a race around the corridor of the hotel. After eighteen rounds Mr. Beefsteak fell out to one side, exhausted, gasping for breath, his heart struggling to carry the burden engendered by the violent exercise, but Dr. Tanner went skipping on. Manifestly this was a victory for oxygen.

5. Cold Applications.—Cold applied to any part of the body acts primarily as an excitant or stimulant by its action upon the sensory nerve endings in the zone affected. Cold excites a decided reflex action, which acts both upon the muscular tissues and the vascular system.

Blood rushes at once to the area that is in contact with the cold application.

The stimulating or exciting influence of a cold application is short in duration. Soon there is induced a benumbed condition, and a long continuance of an extremely cold application will produce complete paralysis.

Cold is often used as an anodyne for the relief of pain, because it destroys the excitability and sensibility of the sensory or afferent nerves, but it is not good practice to deaden a live nerve, because it acts correctly in giving information of lesions causing pain.

Psychotherapy is frequently used in neuralgic affections of the nervous system. Cold applications are used to allay inflammatory conditions in which the processes of inflammation are active.

Cold is also used to abstract heat in feverish conditions from almost any part of the body. Cold or ice packs to the head are frequently used to allay an inflammatory condition. We believe, however, that much harm can be done by the depressing and paralyzing effect of cold compresses to the head, if they are continued without interruption for too great a length of time.

No doubt the continued and injudicious use of cold packs to the head are responsible for fatal results many times in the hands of physicians who do not understand the proper use of this valuable remedial agency. The paralytic effect may be avoided by alternating cold application with applications of heat. If a cold application is applied for four minutes, and a warm application is applied for one minute, and repeated in this way, we may get the depressing and sedative effect of the cold without producing the complete paralysis which we will produce by the continued use of the cold application.

6. Lack of Nutrition.—Lack of nutrition deprives nerves of their excitability and power of action. As

brought out above, a temporary fast does not interfere with the nerve action, because of the fact that nerves are nourished at the expense of other tissues of the body.

The manner in which we learn that nutrition cut off from nerves, depresses their action, is by tying an artery and noting that the irritability is destroyed. Then, by untying the blood vessel and re-establishing the nutrient supply, we note that the excitability and function of the nerve is restored. The same is demonstrated by pressure upon an artery.

When, by occlusion, the artery cuts off the nutrient supply, nerves cease to function. When the pressure is removed and the nutrient supply re-established, the nerve supply will regain its function.

7. Galvanism (Polarizing Current).—Electricity, ordinarily, is a nerve excitant or stimulant, but the polarizing galvanic current benumbs and paralyzes both afferent and efferent nerve fibers. This current completely destroys the excitability and conducting power of nerves, especially when used excessively.

While considering the subject of interference with nerve function, we will call attention to the phenomena which we see continually produced that requires some explanation:

Muscle fatigue is produced by the chemical by-products of metabolic changes occurring in the tissues during exercise. Continued exercise and excessive action increases the production of waste material in the shape of certain chemical elements.

These fatigue elements which produce muscle tire, are in the form of acid salts, acid potassium phosphate, glycerin, phosphoric acid, and carbon dioxide. The proof that these by-products, generated during muscular activity, are the cause of muscle fatigue, is because of the fact that when these elements are washed or thinned by a weak

sodium chloride solution, the muscle fatigue is no longer manifest or present.

Sleep seems to be produced as the result of certain by-products of muscular activity, and ordinarily the more exercise taken, the sounder will be the phenomenon of sleep. In childhood, while the eliminative processes are perfect, and throwing off all the by-products of muscular activity save those which conduce to sleep, there is perfect rest during the sleeping hours.

In after life the sedative effect of muscular activity seems to be nullified to a certain extent by the failure of the elimination of certain toxic elements on the part of the kidneys or skin. These retained toxins in such cases act as excitants, and counteract the somnifacient influences of the normal producers of sleep.

We find that when the eliminating organs are stimulated to normal action by re-establishing normal nerve supply or elimination, that our patient will again sleep as well as in youth.

Deranged function of the mental phenomena may be due to the toxic elements influencing the cellular activity of the centers of intelligence in the brain, and by derangement of the nutrition, and consequently of the metabolic processes, causing an alteration of the cellular tissues of the brain.

Any failure of the normal supply of nutrient elements to the brain substance, or any failure of a proper, free drainage, and any organic lesions of even the slightest degree, will materially interfere with the normal functioning of the brain; hence mental aberrations.

A proper understanding of the etiological factors of insanity would lead to the proper treatment, and our asylums would be quite unnecessary with their present extensive apartments. Many of their inmates could be sent home entirely relieved of all occlusion of nutrient

vessels, physical interference with the nerve supply to the seat of intelligence—the brain—thus normal function would be restored to the great majority of the inmates of our state institutions, which are established for the care of those mentally afflicted.

CHAPTER IV.

NERVE DEPRESSANTS—(Continued).

MENTAL IMPRESSIONS.

IT is a well-known fact that suggestion and mental impressions will affect the brain and nervous system. If you hear bad news or sad news, you are depressed; if you hear good and encouraging news, you are exhilarated. Suggestions that you are sick or looking bad, or that you cannot get well, are very detrimental to recovery; while the reverse suggestions, those of optimism, are really conducive to the recovery of health.

All schools of physicians practice suggestion either consciously or unconsciously. When the allopathic physician gives medicine he usually suggests, when prescribing it, the effects he expects it to have and the effects will follow in the line of the suggestion. Sometimes inadvertently he may give a counter-suggestion. Suppose a physician should say to his patient: "Try this medicine and come back at the end of the week, and if it has done you no good, I have another medicine I want to give you." Do you think that medicine is likely to act? The patient will most likely return for another prescription.

I heard of a physician who gave a rheumatic patient a medicine for rheumatism, and remarked: "If this does you any good, come back and tell me about it, for I have had the rheumatism myself for seventeen years."

There is so much in suggestion that there has been established a school of practice based upon it. For a long time I was inclined to the idea of condemning every other method of healing besides the one I was practicing, but I have gotten over the idea that I know it all and the other fellow knows nothing more than I do.

I remember a case in Oklahoma. Dr. M. had a case of constipation that was very stubborn. He had tried cathartics, and one by one they would lose their efficiency. After the doctor had gone the rounds of the different cathartics he thought he would try suggestion. He suggested to his patient that he had one medicine he had not given her because it was such a powerful cathartic, and that it was so severe in its effects, that he did not want to give it. He left that suggestion with her for about three weeks, and she made up her mind to take that medicine if it killed her. She told him that she had resolved to take that medicine for the better or the worse. He administered some ordinary placebo pills. She went home, and before morning the doctor was called to her rescue, for there was such a drastic cathartic bowel action.

We know of another case in Oklahoma that illustrates the influence of suggestion. A farmer living about six miles east of Oklahoma City, told about the time when he used to take some herb tea that his mother made and gave him for a purgative. Finally this cathartic began to affect him in the wrong manner; in other words, began to induce a condition of constipation.

This man tried auto-suggestion. He would imagine that there were peristaltic movements of the bowels. He would imagine the bowels were going to act, and actually brought on a desire to go to stool. When he first began he would work his auto-suggestion for probably half an hour before he would accomplish the desired effects, but after his mind had practiced this suggestion for awhile, it would work better. When he would begin to think about his bowels moving, he would go, of necessity, at once. There is one thing I believe concerning this remedy: It is better than medicine for chronic constipation.

I heard of a case in an Eastern city that illustrates the

effects of mental influence. A gentleman went to see a doctor, consulted him, and had a thorough examination. The doctor reported the examination to him next day by mail. When the patient read the letter containing the doctor's report he was perfectly surprised. The letter read something like this: "One lung is gone; heart is in bad shape, you cannot live long, the thing for you to do is to make ready your affairs in this world, for you have not long to live." The poor fellow lingered under the influence of that suggestion and took to his bed. When the doctor was called to visit him, the patient said: "Oh, Doctor, my heart, my heart." The doctor said, "I examined your heart three days ago and found nothing the matter with it." "But, Doctor, my lungs." "I examined your lungs about three days ago and found nothing the matter with them." "Where is that letter I wrote you?" the doctor asked. The patient produced it. "But that letter," the doctor said, "was meant for another man." This patient got better right away. He got up out of bed, went to the seashore, and recovered. The letter that went to the other man read something like this: "Nothing seriously wrong; a little rest at the seashore will make you all right." The poor consumptive went to the seashore for rest, and he got well also. We must admit that there is something in suggestion.

V. Structural Lesions.—We may have structural lesions as a result of interference with the processes of metabolism, or we may have structural lesions as a result of injuries, traumatic wounds, etc. In either case, it will be impossible for nerves to function normally through organs which are not organically normal. It is necessary for the structure of the organ to be perfectly normal, that nerve impulse may produce normal function within them. Any interference with the normal impulse which disturbs the metabolic processes in any way, will sooner or later lead to a histological alteration, and then should

the nerve be freed from interference, it is necessary for sufficient time to elapse for metabolic processes to remove this histological obstruction before nerve impulse can produce normal functional processes.

VI. Traumatic Alterations.—In the case of traumatism produced by accident or by surgery, in which tissues have been removed, or in which nerves have been severed, it is impossible to ever restore normal function again. If a patient has lost one finger, he can never grow another. The crawfish that has lost his pinchers may grow others, but to an unfortunate child which was born without an extremity, we will never be able to restore a normal limb or part thereof. To a person who is minus some of his organs by reason of an operation, we will never be able to restore the organ, nor be able to overcome the lack of the internal secretion produced thereby, as in the case of the ovaries.

When nerves are severed, and when their terminal branches are degenerated as a result thereof, we are not able to again restore the function that is normally maintained by that nerve.

VI. Mechanical Interference.—Mechanical interference with nerves and derangement of function by reason thereof, is by far the most common of all agencies of interference with nerve function. Mechanical interference with nerves, however, had been almost wholly overlooked as an etiological factor of abnormal function and disease.

Mechanical action which interferes with the histological particles of a nerve within a certain range of rapidity, becomes a stimulus or an excitant or irritant of that nerve. When the mechanical action is sufficient to destroy the continuity of the conducting cellular tissues of the nerve—the axis cylinder—the nerve is paralyzed, and the nerves will undergo degeneration from the point

of the lesion or impingement peripherally, as a result of a permanent disturbance of the cellular arrangement of the nerve particles.

A slight impingement or pressure upon a nerve causes the nerve to become tender, sensitive, and very excitable, which condition increases its action.

If, however, the impingement is long continued, a secondary effect will ensue. The nerve then will fail to possess the excessive or normal amount of excitability and transmitting power. A very slight impingement, however, may act as an excitant or stimulant for a long period of time.

Mechanical stimulation of peripheral afferent nerve endings is normally present in a majority of the processes of vital activity throughout the entire body. In the alimentary tract we have an example of the mechanical stimulation of afferent nerve endings, and reflex afferent responses, throughout its entire length.

Food in the mouth is the mechanical stimulus that excites glandular secretion in the form of saliva. We know that this reflex secretion of the salivary glands is in response to mechanical stimulation, from the fact that the saliva will flow from the presence of any form of matter that is placed in the mouth, provided the processes of mastication are carried on. Saliva flows during the mastication of food; it will also flow while chewing a stick, and will even flow while chewing tobacco.

It makes no difference what the nature of the mechanical stimulation is. We always have a response in the flow of saliva, which proves conclusively that purely mechanical stimulation will excite the action.

In the event of deglutition, we have an example of reflex muscular movements in response to the stimulation of the bolus of food. Except the initiatory movement of

deglutition, the entire process is that of a reflex muscular contraction in response to afferent excitation.

In the stomach, we have the same phenomenon, namely: The presence of food exciting the peristaltic movements and the secretion of the digestive fluids of the stomach. In the intestinal action we have the same phenomenon repeated. The point we would especially call the reader's attention to in this article, is that of the mechanical interference with nerve action. This is usually produced by a narrowing of the intervertebral foramen which causes an impingement of the nerve sheath at its point of exit from the neural canal. A slight impingement of the nerve sheath, especially if it affects the nerve contained therein, will excite to overaction the nerve passing therein. The nerve may become very tender, sensitive, and excitable, and hence all afferent stimulation excites an impulse above the normal, and the consequence is an overaction of the motor nerve in response to the stimulation.

The impingement may be sufficiently heavy to cause a pain, and this is proven by the fact that when the contraction of the spine, which is causing the narrowing of the foramina, is overcome, the pain and sensitive condition of the nerve is entirely relieved.

As indicated above, if the nerve is impinged for a long time, there may be a loss of the sensibility, and consequently a lack of response to stimulation. There may also be an interference with the transmission of impulse by the nerve because of the mechanical interference.

If the impingement is heavy, the excitable stage is of less duration, and more quickly does the nerve become paralyzed and lose its power of action. We enumerate

some of the different ways in which mechanical stimuli may be applied to a nerve:

1. Blow.
2. Section.
3. Traction.
4. Puncture.
5. Pressure.
6. Crushing.
7. Percussion.

CHAPTER V.

SPINAL LESIONS.

THE subject of spinal lesions and the methods of correction thereof, have probably received less attention, considering the great importance thereof, than any subject of like magnitude relative to pathology and disease. Gross or major lesions of the spine have forced their attention upon the medical profession generally, but minor spinal lesions and those not visible to the casual observer, have been passed unnoticed except by those who have given special attention to the study and practice of the science of spinal adjustment.

There has been some reference made to the association of spinal lesions with certain functional derangements, by members of the medical profession, but an extended study of this subject has not been made until the appearance of some more recent schools of practice upon the scene. We find that references made to this matter in the past are but few, and the study that has been made of it, very limited compared with its importance.

William and Daniel Griffith, physicians of England, published a report of 148 cases, in which they associated the ailments of their patients with manifest spinal lesions, or spinal tenderness. By them the phenomena of disease were studied relative to spinal nerve tenderness in certain regions or spinal segments. They decided that tenderness of a spinal segment was either the result of a visceral disease, or that it was the cause of the disease. They queried as follows:

We should like to learn why pressure on a particular vertebra increases or excites the disease about which we are consulted; why it at one time excites headache, or

croup, or sickness of the stomach; why in some of these instances any of these complaints may be called up at will by pressure upon a corresponding point of the spinal column. The following report of these cases summarizes briefly the results of their investigations: In an examination of twenty-eight cases, in which there was discovered cervical tenderness, it was found that the patients were suffering with headache, nausea or vomiting, facial neuralgia, fits of insensibility, and affections of the upper extremity. Two cases only had pain in the stomach, while only five of the twenty-eight suffered with nausea and vomiting.

In forty-six cases that were found to have cervical and dorsal tenderness, the following derangements were noted in connection with those enumerated in the above cases, which were associated with cervical tenderness: Pyrosis, palpitation of the heart, and general oppression.

Thirty-four of these cases suffered with pain in the stomach, and ten cases suffered with nausea or vomiting.

They report twenty-three cases of tenderness in the dorsal region, with the following symptoms: Pain in the stomach and sides, cough, syncope, hiccough, and eructations of gas. In one case only, nausea and vomiting. In almost all of these cases there was pain in the stomach.

They report also fifteen cases in which there was dorsal and lumbar tenderness, which they elicited by palpation. The symptoms attending spinal lesions in these two regions, according to their report, were pain in the abdomen, loins, hips, lower extremities, dysury, ischury; in addition to the symptoms attending the twenty-three cases of dorsal tenderness. In only one case was there nausea.

Thirteen cases which were found to have tenderness in the lumbar region, are reported with the following symptoms: Pain in the lower part of the abdomen, dysury, ischury, pain in the testes or lower extremities,

and disposition to paralysis. In only one case was there spasms of the stomach and retching.

Twenty-three cases suffered with tenderness in all parts or segments of the spine. In these cases the patients were found to have a combination of the symptoms of all of the foregoing cases.

Five cases of the 148 reported, exhibited no tenderness upon palpation of the spine, yet they suffered with the same disease as those that suffered with tenderness when palpated.

At this same period—about 1834—Swedish gymnasts observed among those suffering with cardiac diseases, tenderness over the fourth and fifth dorsal nerves, upon palpation.

The Swedish school recognized definite areas of spinal tenderness associated with diseases of different organs.

Tenderness over the sixth, seventh, and eighth dorsal nerves on the left side, was associated with stomach troubles.

In 1841 a memorable work was published by Marshall Hall, which established the importance of the spinal reflexes. The above information was gleaned from Spondylotherapy by Dr. Albert Abrams, of San Francisco, who has done humanity a blessing by his able work and writings.

An interesting article is furnished us by T. E. Williams, M. D., of Eau Claire, Wisconsin, concerning some attention given to the subject of spinal lesions and spinal treatment, in the years 1828 to 1851, which article follows:

In the past few years I have been looking through the literature of many of the older authors on medicine and surgery, hoping by so doing to find someone who at least observed something, if only in part, teaching on subluxation of the vertebræ and adjustment of the same.

In gleaning here and there through a large number of old volumes, written many years ago, on diagnosis,

medical practice, surgery, and neurology, I found the field, with the exception of the writings of two medical men, who briefly referred to the principles embodied in spinal adjustment, quite barren; and that which I found on the subject came from Scotch and English authors.

The two medical men mentioned had certainly grasped the true idea of spinal lesions in as modern a way as our Dr. Gregory, or any of the rest of our leading thinkers, and what they have said on the subject was to the point. In fact, these two men were strong and vigorous adherents of the fact that spinal lesions are etiological factors, as far as the light of the age in which they lived permitted. I will proceed, that you may know who they were, and also what they had to say.

There appeared an article on "Irritation of the Spinal Nerve," by Thos. Brown, M. D., in the Glasgow Medical Journal, Vol. I, page 131, 1828, in which Dr. Brown makes the following statement in a straightforward manner: "The immediate cause is spasm of one or the other of the muscles arranged along the spine, altering the position of the vertebræ, or otherwise compressing the nerves as they issue from the spinal marrow."

Most of us can fully agree with Dr. Brown's statement, that minor subluxations of the vertebræ and compression of nerve sheaths offer sufficient cause to bring about "irritation of the spinal nerves," as well as affect the nerves in the remote parts of the body.

I now wish to call your attention to a statement made by another author in Guy's Hospital, London, England, in clinical lectures on "Rest and Pain," namely, Dr. Hilton. In the following statement by Dr. Hilton we will find something of practical interest and diagnostic value. Now listen: "If a patient complains of pain on the surface of the body, it must be expressed by the nerve which resides there; there is no other structure that can express it, and somewhere in the course of its

distribution, between its peripheral termination and its central, spinal or cerebral origin, is where the precise cause of pain, expressed on the surface, must be situated."

We quote you one of his cases and the method he employed in adjusting a vertebra: "On the 18th of March, 1851, Mr. Ray, of Dulwich, brought me a boy eight years of age, who had been suffering from severe pain during January and February, just above the pit of the stomach, and who used to walk about with his hands placed over that region, with the body inclined a little forwards as if suffering from some irritation or pain, of some of the abdominal organs, in which the treatment had hitherto been chiefly supplied, but without much benefit. It was noticed that the pain was increased during the maintenance of the erect posture, and that it was relieved by the recumbent position. The child was old enough to express a little of what he felt, and when asked where the pain was, he put both his hands over the stomach, where he had previously complained of pain; and we observed that the pain was expressed on both sides alike. I requested that he might be undressed so that we might examine the spine. We now found that there was tenderness and slight displacement between the sixth and seventh dorsal vertebræ, and pressure upon these vertebræ produced the pain in front. The real cause of the patient's symptoms was now apparent, and spinal rest for three or four months upon a hair mattress, cured him."

The language of the two medical men in 1828 and 1851, and that of the modern chiropractors, are remarkably similar in their characteristic expression.

In the London Hospital, in 1894, Sir Wm. Gowers, the eminent neurologist, said, that "function depends upon the release of force—nerve force." This last statement conveys more than an ordinary meaning to those engaged in spinal adjustment, for that is the very thing they

claim to do, and do it to the satisfaction of nearly everyone who takes spinal adjustment.

In our study of this subject, we will confine ourselves more especially to a consideration of the minor lesions of the spinal column that interfere with the nerve sheaths coming out from the spinal neural canal. These lesions are best discovered by palpation, and are discernible only to the palpators with trained fingers in this line of work, but their importance renders the painstaking practice necessary to discover the existence of these minor lesions, well worthy of our consideration and patience.

I do not know of any subject that is of more importance and more interest to us than this one. I do not believe there is any subject as poorly understood, or understood by so few, as this one. I do not believe any other subject has been as erroneously presented to the attention of the people generally, as this subject by those who practice spinal adjustment.

Some of our intelligent surgeons and physicians consider spinal lesions an impossibility, except complete subluxations. They do not consider that there is any relation existing between ordinary disease and its cause, and spinal lesions.

There are others, especially among those of the osteopathic and chiropractic persuasion, who believe that these lesions are associated with all disease, both acute and chronic, and some go so far as to believe that spinal lesions and the consequent nerve impingement are the primary, absolute, and sole cause of all disease, acute and chronic.

The idea that a great many of these people have of the nature of spinal lesions, is, to the mind of the writer, very erroneous.

Now what are spinal lesions? I believe a good defini-

tion for a subluxation or spinal lesion would be this: *Any deviation from the normal approximation of adjacent vertebræ.* We find that people generally possess a misunderstanding of the meaning of the term subluxation. Many do not seem to understand the difference in the meaning between the term subluxation and luxation. They seem to consider that a subluxation is a luxation, but that it consists of a smaller degree of malposition.

We should ever bear in mind, when speaking of a subluxation, that the term when applied to a vertebra, does not mean a luxation thereof but merely a deviation of it from its normal relation and approximation to adjacent vertebræ. It is evidently a fact that subluxations that interfere with nerves most, are approximations of vertebræ of such a nature as would narrow the intervertebral foramina.

The above would not only be the common cause, but the only way lesions would cause interference with the spinal windows—except contractions of ligaments which would slightly rotate a vertebræ upon its axis.

The foramina along the spine are formed by the notches in the pedicles of the vertebræ. Each pedicle has a notch on both its superior and inferior edges. The superior notch in the pedicle of one vertebra is, or should be, even with the notch in the inferior surface of the pedicle of the vertebra above.

The most natural cause of a lesion, therefore, would be an approximation. The manner in which the spine is built, the different sets of ligaments that hold it in place, would almost preclude the idea of a vertebra slipping to one side, and in this way interfering with the size of the foramina or nerve sheaths.

If vertebræ are approximated, this would be in perfect keeping with the law of contraction of the tendons, muscles, and ligaments. Consequently, the most common

cause of lesions is the contraction of the tendons, muscles, and ligaments of the spine or spinal musculature.

The contraction of the spine may affect one side, or it may affect both sides. It may be on the anterior or on the posterior surface of the spinal column. We may have a combination of an anterior or posterior and the lateral approximation.

We have vertebræ one above the other, and the cartilages in between holding them apart. The cartilages are normally as thick on one side as on the other. Imagine

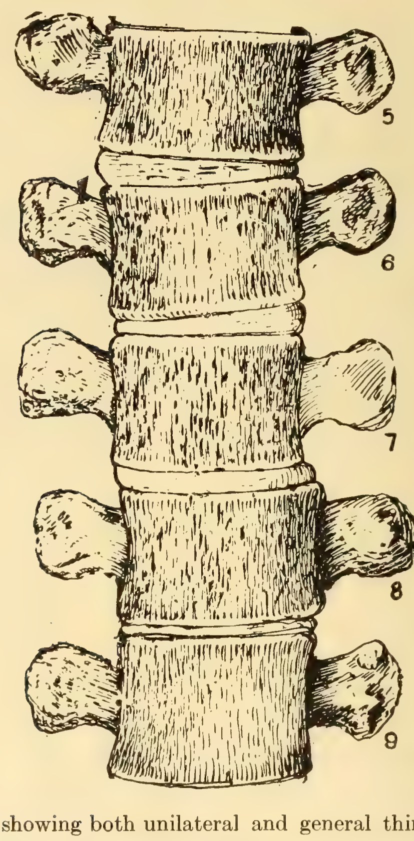


Illustration showing both unilateral and general thinning of the intervertebral cartilages between the centrums of the vertebra. (Courtesy M. E. Clark.)

one vertebra being directly above the one adjacent below it. Imagine a contraction of ligaments on one side, and you will have an impingement of the cartilage on the same side, and a lateral approximation of the centrums of the vertebræ, upon the same side, and a consequent narrowing of the foramen.

Not only do we have this impingement upon the one side, but we have an apparent malalignment of the

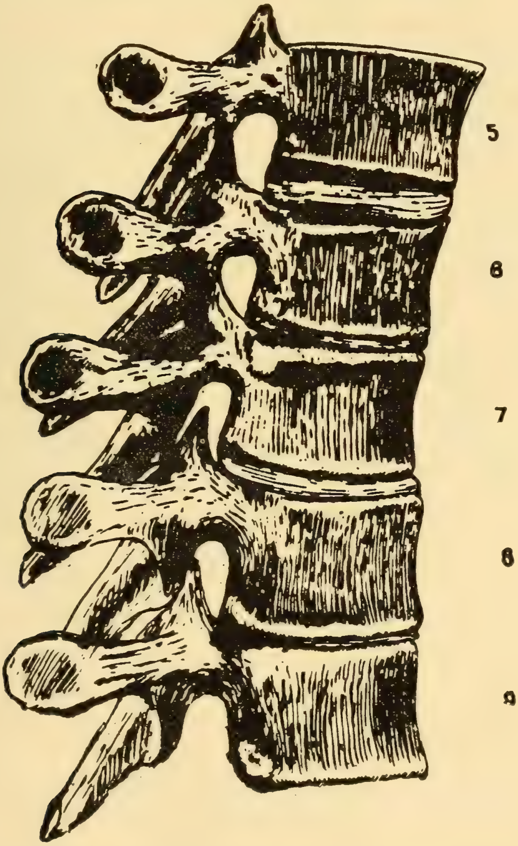


Illustration showing how unilateral or general contraction of the ligaments or settling of the spine will interfere with the integrity of intervertebral foramina. (Courtesy M. E. Clark.)

spinous processes, because as the vertebræ approximate on one side, the spinous processes will show it by their positions and their failure to be in normal alignment. If you have a contraction on both sides, there is only an approximation of the processes and centrums instead of a malalignment.

CHAPTER VI.

CAUSES OF SPINAL LESIONS.

THERE is not only a failure on the part of the laity but also a failure on the part of the practitioners of the healing art generally to recognize spinal lesions and their importance as etiological factors in disease.

For the above reason there has been but little attention given to the subject of the cause of spinal lesions, notwithstanding the fact that the subject of the cause of spinal lesions is one of great importance.

This subject is not understood properly by many of the practitioners of spinal adjustment, and for the above reasons we feel the necessity of considering this subject more thoroughly in this chapter.

We enumerate below some of the more important causes of spinal lesions which act directly upon the spinal column or spinal tissues or musculature.

An important question is, what causes these ligaments to contract? I will enumerate some of the causes, under the following heads:

I. Jars.
II. Falls.
III. Blows.
IV. Strains.
V. Settling.
VI. Twisting.
VII. Muscle tire.

Under these heads I have tried to enumerate the principal causes acting directly upon the spinal column and causing lesions thereof. It is necessary to make a few remarks explaining how and why these causes will produce spinal lesions.

I. Jars.—Jars, because of their violence, may injure the spinal tissues, and thus cause their contraction.

Continuous jarring, as riding on a train, will cause a settling of the spinal column and thinning of intervertebral cartilages.

Engineers are liable to be affected with certain ailments which are associated more especially with a settling of the spine and consequent interference with the lumbar nerves. This seems to be the result of the continuous jolting and settling, incident to their occupation, and also the greater amount of the superimposed weight of the body upon the lumbar vertebræ.

II. Falls.—A fall of any violence is liable to injure the musculature of the spine, and thus cause a decided irritation and contraction of the spinal musculature. Many cases have come to the attention of the author during the last three or four years that date their trouble back to some fall which produced a lesion of the vertebral column. One case was that of a man who had fallen from a pitching horse. He was thrown several feet in the air, and alighted upon the upper part of the thoracic portion of the spinal column. As a result of this fall he suffered for several years until he fell into the hands of the author, when he was relieved of any further difficulty with the nerves and functions of the viscera of the thoracic cavity, which were interfered with by lesions from the fall.

One case that came under our attention was that of a lady who, at the age of 18 years, had fallen from a wagon on a public road. The worst lesion produced by this fall was in the lower portion of the thoracic region of the spinal column. As a result of these lesions, and interference with the nerves of this part of the spine, she had a prolapsed or floating kidney on each side. She lived in this condition a number of years, but was practically an invalid a great portion of the time. The physician

who attended her could not believe that it was the kidneys that were palpated so low in the abdominal cavity as he found them. Her life was finally despaired of, and in that condition she came to our office.

By relieving the contractions in the lower thoracic region, we restored the nerve supply and tonicity to support of the kidney and she was restored to health, and the kidneys were restored to their normal condition, and now after a period of over three years she is strong, robust, and in better health than she has been since the occurrence of the accident.

On the other hand, falls have done patients good. We have read of cases in which the trouble was relieved by a fall. Cases of this kind seem to be miraculous. Since we hear of so many cases being relieved by a fall, there must be a reason, and that evidently is due to the fact that some contracted portion of the spine is loosened, and the nerves that have been impinged are freed, and thus normal function is restored.

It seems a pity, however, that practitioners of the healing art have given so little attention to spinal lesions, as to have to leave these patients unaided until they accidentally fall downstairs to get well.

III. Blows.—Blows which injure the musculature of the spinal column may cause contraction of the muscles and ligaments of the spine because of the contractured condition that follows irritative or traumatic lesions. Blows must be of sufficient force to injure the musculature of the spine before they become an exciting cause of spinal lesions. Blows which injure, irritate, or excite peripheral endings of any of the afferent nerves, may reflexly cause spinal contractions and consequent lesions.

IV. Strains.—Strains are another cause of spinal lesions. A strain of the ligaments or tendons of the spinal musculature will injure, rupture, or break the fibrilla of the tendons or ligaments.

A strain will excite an irritation and cause a contraction of the musculature of the spine, especially of that portion of the tissues which is injured by it. Ligaments and tendons so injured will contract and approximate vertebræ, causing impingement of nerves; and heavy impingement will cause decided derangement of function and often intense pain.

If a person is lifting in a strained position, he is apt to injure the ligaments of the spinal column, more especially those of the lumbar region. An injury of the musculature of the spine, in the lumbar region, or elsewhere, will cause what is known as a "catch in the back." This condition will often come on very quickly after a violent strain and injury of the musculature of the spine.

It seems that the contraction of the tissues of the spinal column is a very sudden occurrence, resulting from an irritative injury to the connecting tissues of the vertebræ of the spinal column. Sprains of the joints of any part of the body and of the extremities, will affect the spinal column because of the reflex contractions produced by the painful irritation of the afferent nerve endings in the joint or part that is injured.

V. Settling of the Spine.—The settled shortened condition of the spinal column is a condition coming on slowly and is most common among people in the decline of life. The spinal column of many chronic sufferers may become reflexly involved. They become stooped, curved, and shortened as the result of contraction of the musculature of local segments of the spine.

Actual measurements taken of people when they are just reaching full development, and measurements of the same persons when they have reached the age of sixty or seventy years, show that the great majority of people become from one and a half to three inches shorter when they grow old.

This shortening is at the expense of the intervertebral cartilages in most all cases, especially that coming on as the patient advances in years. The settling of the spine takes place very gradually.

It is a well-known fact, that we settle in height every day to a greater or less extent, during the time from rising in the morning until going to bed at night. The

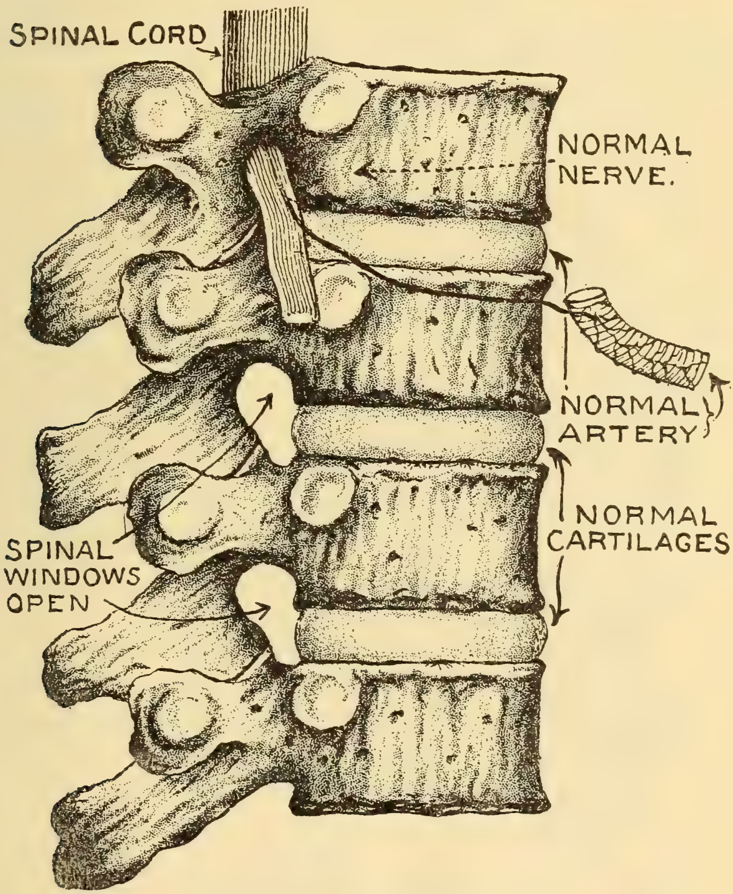


Illustration showing the normal intervertebral discs, the open spinal windows, and the normal nerve sheath, with the nerve and artery normal in size. (Exaggerated.) (Courtesy S. C. Mathews.)

more laborious our work, the more our muscular exercises, and muscle tire, the more consequent settling in height will take place.

This is due to the result of muscle tire because of overwork, especially if it causes a depression of the tonicity of the erector muscles of the spine. This muscle tire permits of an excessive settling of the spine.

If we take a careful measurement of our height in the morning, we will find that we have increased in height during the rest and relaxation of the night.

During the early years of life, when our rest is perfect,

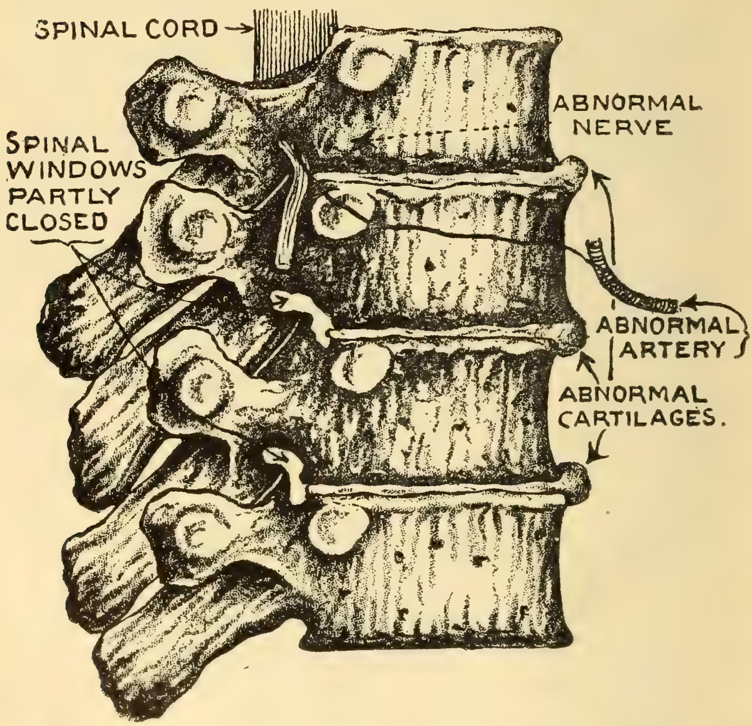


Illustration showing an extremely settled condition of the spine. The intervertebral discs are very thin, and the spinal windows are narrowed. The spinal nerve and the artery are impinged and reduced in size. This is a condition coming on with age. (Exaggerated.) (Courtesy S. C. Mathews.)

the relaxation and expansion of the night will overcome the settling of the spine during the preceding day. For this reason as the years go by during the stage of development, we will lose nothing in height. While we are young and growing we will gradually increase in height and in the length of the spine, and there will be no shortening of the spinal column take place until we have passed the meridian of life.

Age Comes On.—This condition of youth does not always continue, we finally reach the zenith of our strength and development. When we enter upon the decline of life we will become more exhausted as the result of a day's work, there will be more of the settling of the spine, because of the increased exhaustion. At the same time we find that a person will begin to fail to sleep and rest and the relaxation will not be so perfect as in his youthful days.

The expansion and relaxation of the spine, occurring during the night, does not compensate for the settling of the spine during the previous day. The difference between the settling of the day and the expansion of the night is imperceptible in amount. An accumulation of the imperceptible differences of the settling and the expansion of the daily cycle, will, as the years roll by, tell in inches, in the height, as the patient grows old.

The more excessive the muscle tire from a day's laborious work, the more settling of the spine will occur. Muscle fatigue beyond a certain amount becomes a pathogenic factor.

As the years pass by, and as the spinal column becomes shortened, we know that the shortening is wholly at the expense of the intervertebral cartilages. The bones of the legs will not shorten; the vertebra of the spine will not become compressed; the shortening of the patient and the spinal column is wholly at the

expense or the result of a decrease in the thickness of the intervertebral cartilages.

After the settling that has taken place during the years of a person's life, that has not been compensated for by expansion, the spine will become shortened. The combined thickness of all of the intervertebral discs is, on an average, about one fourth of the entire length of the spinal column, exclusive of the first two cervical vertebræ.

Since the shortening of the spine is at the expense of the intervertebral cartilages, the shortening occurs in proportion to this thinning. As the intervertebral cartilages grow thinner, the intervertebral foramina become narrowed; the sheath that contains the nerves, arteries, veins, lymphatics, etc., becomes slightly impinged and occluded.

The patient has probably lost nearly half of the vertical dimensions of the intervertebral foramina, and the nutrient supply and the drainage of the spinal segments are interfered with throughout most of the length of the spinal column in proportion to the occlusion of the neural sheath.

When spinal settling begins to cut off or narrow the channels of the life force either by interfering with the nutrient vessels, by cutting off the circulation to the nerve centers, or by interference with the nerves as a result of compassion or impingement—we begin to have interference with the transmission of the normal impulse and deranged function to the organs supplied.

You will find that the old man's organs and viscera do not function normally; the heart does not do its work well; the kidneys are not performing their functions normally; the nerve supply to the bowels is not free and normal, and we have a general hypo-tonicity of both the muscular walls and the glandular coats of the bowels. There is a general paralytic condition present, and as a

result of the non-excitability of the afferent nerve endings and the lack of the peristaltic and secretory reflexes resulting, many suffer with chronic constipation.

Here is a field for the practitioner of spinal treatment. It falls to the lot of some practitioners to prevent the unfavorable effects of the settling of time upon the spine of the aged. We have been able to accomplish much good along this line of work. If the spinal nerve supply is kept normal and the tonicity of the erector muscles of the spine is maintained, the spine will be retained in a normal condition much better than when there is a lack of muscle tone. Muscle tire and exhaustion will depress the muscle tone, and will always permit more or less settling to take place.

We have a compensatory change that takes place in the spine as age comes on, which consists of an alteration in the conformity of the normal spinal curvature, which in a way provides for the nerves in the settling of the spine, by preventing the narrowing of the spinal foramina. This change is simply a forward bending of the spine.

By an examination of the bones of the spinal column, and especially if you notice the superior articular processes of the vertebræ, you will see how the processes of the vertebræ below pass up over the foramina above. You will then understand that by a backward bending how the articular processes are forced into the foramina and how they partially obliterate them.

The forward bending, however, will move the articular process backward instead of forward. In this way, the spinal openings are not so much interfered with. The intervertebral cartilages will be thinned between the anterior portions of the centrums of the vertebræ, while the cartilages between the posterior portions will not be so thinned, and hence the forward curve of the spine of the old man compensates in a great measure for the settling of the spine coming on with age.

VI. Twisting.—Twisting of the spinal column may engender interference with nerves, and the twisting may be induced in several different ways:

A wrench of the spine in a rotary manner brings a great strain to bear upon the ligaments that hold the vertebræ in approximation.

Injury to ligaments, tendons, or any of the tissues of the spine, will cause contraction, it matters not in what way the injury is produced.

During life a great many people take very little exercise, or make but few movements that call into action the musculature of all parts of the spinal column. For this reason the musculature of the spine is undeveloped, and is not strengthened. Patients who lie in bed a great deal of the time without using the erector muscles of the spine to hold them in an upright position, or when they do not exercise any of the muscles of the spine, the entire musculature of the spine becomes weakened. In such cases, the mere act of turning in bed might possibly stretch or injure the ligamentous bands that bind together the vertebræ. The injury might be of sufficient magnitude to cause a contraction and what is termed a "subluxation."

To people in active life, who bring into play the musculature of the spine more or less by reason of their occupations, there is little danger ordinarily of twisting or bending of the spine having much influence or detrimental effects upon the rectitude and integrity of the spinal column. Violent twisting, however, may produce lesions of even the well-developed spines.

Exercises that bring into play the musculature of the spinal column, will tend to strengthen and to protect the spinal tissues from injury because of any internal violence or wrenching. We notice examples of this in professional wrestlers. In some occupations people will allow their spines to be held in a certain twisted or bent condition.

Abnormal conditions of the spine that are maintained for a sufficient length of time, will lead to constructive changes in all of the tissues pertaining to the spinal column. The intervertebral cartilages will become thinned on one side, and thickened on the other; the muscles will become shortened on one side and lengthened on the other, until there is a permanent deformity of the normal outline and conformation of the spinal column. We have examples of this in people who work at desks, with one shoulder held higher than the other, and we also see examples of this in case of chronic pain or affliction.

VII. Muscle Tire.—Fatigue of the muscles, especially of the erector muscles of the spinal column, is a direct cause of the settling of the spinal column. Fatigue of the muscles of the spine is responsible for the shortening that takes place during the day's exercises.

Massage, or vibration of the muscular tissues of the spinal column, will relieve the tired feeling that comes as a result of the general fagging and settling due to muscle tire.

Thrusts, to overcome the settling that has taken place during a hard day's work, which affect the intervertebral cartilages, will re-establish nourishment to the different segments of the spinal column, will restore nerve impulses of normal magnitude and quickly relieve the tired feeling.

The fact that massage, vibration or thrusts given to open up spinal articulations, will relieve the tired feeling, proves that the tired feeling is the result of spinal settling and of the mild interference with the nutrition or drainage of the spinal cord, and consequent depressed nerve tone.

We know that any alteration in the nutrient supply or drainage to and from the segments of the spinal cord, affects both the reflex transmission of afferent impulses

and the generation and distribution of the physiological stimuli that is continually going on.

In the case of a slight settling of the spinal column from a day's work, no doubt the venous channels are mostly interfered with. The walls of the venous channels are less resistant than are those of the arteries and nerves, and for this reason a slight narrowing of the intervertebral foramina will affect first the venous drainage of the spinal segments. The venous supply of these segments is laden more or less with the chemical by-products of muscular activity, and these facts account for the depressing effect upon the spinal centers.

There are conditions existing in some youths in which there is a general hypo-tonicity of the musculature of the spinal column. For this reason the spine will settle and curve, and we find young people with spinal curvature apparently due to this reason.

In our experience in spinal treatment we find that after opening up the spinal articulations of the different regions of the spine in which the abnormal curvature exists, that the patient will stand erect, which is no doubt due to the re-establishment of the normal nutrient supply, and the normal channels of drainage, which engender normal physiological nerve impulse, and the normal reflex transfer of all afferent impressions; consequently the normal tonicity is restored to the musculature of the spine, which musculature maintains the spine in the erect and proper position.

CHAPTER VII.

REFLEX SPINAL LESIONS.

IN this chapter we wish to consider a subject that has been almost wholly overlooked by practitioners of the healing art. We know of no literature extant that goes into a study of the subject of reflex spinal lesions. There is probably no more important, nor more constant, nor more potent agency in the development of pathological processes of acute disease, and in the continuation and development of chronic disease, than spinal lesions produced by reflex contractions.

Nine tenths of all spinal lesions of a minor nature which interfere with nerve function, are produced through the agency of the reflex action of the nervous system. Many who have made a study of spinal lesions and of spinal adjustment, have disputed the fact of the phenomena of reflex action. This act on their part has blinded their eyes to the true philosophy of spinal lesions and spinal treatment, and to-day the majority of those practicing spinal adjustment are almost wholly ignorant of the underlying principles of chiropractic spondylotherapy because of their erroneous ideas and teaching.

No one without a correct knowledge of the existence and influence of the reflex cycle phenomenon, can ever account for the many spinal lesions that are ever occurring in connection with acute disease. That we may be able to more easily comprehend the phenomenon of reflex action which is the most common cause of spinal lesions, we will first consider for a moment the reflex apparatus and the reflex phenomenon. The elements necessary to the reflex cycle are as follows:

1. A stimulus.
2. A receptive apparatus.

3. An afferent conduction tract.
4. A central transferring station.
5. An efferent tract of conduction.
6. Terminal organs or tissues supplied.
7. Terminal nerve end-organs in tissues.

The reflex phenomenon consists of an afferent impulse and central transfer, and an efferent impulse and action depending upon the nature of the tissues in which the centrifugal impulse terminates.

1. Afferent nerves are prepared for the reception of an impulse at their peripheral endings.

2. Every afferent nerve has its own special reflex center in the gray matter of the spinal cord.

3. The efferent nerves are prepared for the reception of centrifugal impulses at their central ends.

4. The specific energy or nerve impulse travels over the entire length of the afferent tract from its peripheral end apparatus to its central termination.

5. This impulse, that is then transferred from the afferent to the efferent nerve, then passes over the entire length of the efferent motor nerve tract from its spinal origin to its end-organ.

Since the afferent impulse must be carried from the periphery to the center by means of the sensory nerves, the entire length of that nerve is thrown into a state of excitability during the reception and conduction of the impulse.

The impulse after being transferred to the efferent nerve, travels over its entire length, from its spinal center to its peripheral end-organ. The entire motor nerve then is thrown into a state of excitability and action.

One important fact should be remembered in this connection: Since the entire motor tract is thrown into a state of excitability by reason of the return conduction of the reflexed impulse, all of its branches will be thrown

into a state of excitability, and action will be produced in the tissues in which they terminate.

The ordinary arrangement of the spinal nerve is that after emerging from the spine, it divides after the following plan:

The first branch given off is the primary posterior branch, or division.

Another branch given off, especially throughout the thoracic region, is the white rami communicantes to the relative ganglion of the sympathetic cord.

Of the remainder of the nerve is formed the anterior primary division of the spinal nerve, which in the thoracic region supplies the intercostal muscles and intercostal space.

During the course of this nerve, it gives off the lateral cutaneous branch which divides into an anterior and a posterior division supplying the cutaneous surface over the corresponding intercostal space.

The most important branch of the spinal nerve relative to causing spinal lesions is the posterior primary division that ramifies and supplies the musculature of the relative segment of the spinal column.

Following an impulse from the transfer station of the reflex center in the spinal column, we find the root and central end of the motor nerve first thrown into a state of excitement. The primary posterior branch of the spinal nerve is the first nerve branch that the impulse will reach, and consequently the first branch to produce action in the tissues in which it terminates.

The impulse traveling further along on the efferent nerve, will reach the peripheral end of the primary anterior division, and produce action in the zone supplied. The first effect, then, of an efferent reflex impulse, is an excitation of the nerves to the musculature of the spine.

The action produced by the peripheral endings of the anterior primary division is a secondary phenomenon.

For an example, we will consider the act of putting our finger on a hot stove, when we are not aware that the stove is hot. The finger comes away before we know it. Now, what has happened? An impulse of excitation has passed over the afferent nerve to that nerve's special center in the gray matter of the spinal cord. It is transferred to the motor nerve; it is transmitted back, and contracts the muscles of the fingers and jerks them away. This action takes place so quickly that this same impulse, or that part of it which has been sent to the brain, does not reach the centers of intelligence, and is not interpreted by the brain until after the hand is taken away; but there is something else happening at the same instant in connection with this phenomenon.

That impulse has had to travel the entire route of the afferent nerve, and after being transferred has had to travel the entire span of the efferent nerves, and it excites action in all branches along its efferent route of transmissions.

The first branch of the efferent nerve is the posterior primary division, and it ramifies and supplies the musculature of the spine and the next branches to the muscles of the arm that is in the brachial plexus.

Now this impulse that has been generated because of the irritative influence caused by the excessive heat, and traveling, as it does, over the entire length of both afferent and efferent nerves, has thrown into a state of excitement all the branches of that efferent nerve; consequently we find that not only are the muscles of the finger contracted, but also the muscles of the arm and the muscles of the shoulder are contracted. But first, and before this has occurred, the posterior primary division has been excited and the musculature of the spine has contracted.

The action produced by the efferent nerves always corresponds to the tissues in which the centrifugal

impulse ends. If the afferent impulse ends in glands, it will produce secretion or excretion; if in muscles, contraction; and as the posterior primary division of the nerve ends in the musculature of the spine, the effect produced is, of necessity, contraction, and that means contraction of the musculature of the spine.

Since the impulse reaches the primary posterior division of the spinal nerve first, the contraction of the spinal musculature will precede the contraction of the muscles of the arm, and the contraction of the muscles of the arm will precede the contraction of the muscles of the finger, as the muscles of the finger are most peripheral, and consequently the impulse reaches them last.

Any excitation or irritation of the afferent nerve endings will ever produce the reflex phenomenon, provided the excitability and conductivity of afferent and efferent nerves are normal, and provided the reflex center of the nerve affected is intact and functioning normally.

A great many agencies act as afferent nerve irritants; consequently we have constant influences and constant action upon the spine in many cases when we are entirely unaware or unmindful of the fact.

Now, in presenting the above, we know we are presenting something that is entirely new, and we are presenting something that we have never seen in writing or heard from the lips of any teacher. For that reason we feel justified in bringing some reasons to bear to show the correctness of the above conclusions.

We have stated above that muscular contractions are produced because of impulses passing over efferent or motor nerves. The simple contraction of muscles will do them no harm; in fact, a normal amount of contraction and relaxation is necessary to the development and maintenance of the strength of the muscular tissues, but we must not violate the physiological law of the contraction of muscles by excessive action.

There are chemic and thermic changes that take place in muscular tissues as a result of their contraction. Continuous contraction will materially alter the condition of the muscle. In the simple act of muscular contraction, the muscle shortens, thickens, and becomes more condensed; or, in other words, its specific gravity is increased.

Following an excessive and continued contraction, we get a condition of contraction remainder, or a contractured condition, because the muscle no longer dilates or expands to its normal length and condition, but owing to the toxic elements produced by the contraction, it remains shortened, contractured, indurated, and perhaps tender and sensitive.

The muscles, ligaments, and tendons of the spinal column are of the same nature as are similar tissues of other portions of the body, hence contract and undergo similar changes and are affected in like manner.

We may enumerate some of the more common causes of reflex contractions under the following:

I. Burns.
II. Strains.
III. Wounds.
IV. Irritation.
V. Dampness.
VI. Cold drafts.
VII. Bacterial infection.

The amount of the effect upon the spine in the way of producing lesions, depends upon the amount of irritation that is produced by the application or contact of the exciting cause.

For an irritant exciting an afferent nerve to produce a spinal lesion, it is necessary that this exciting influence be continued for a sufficient length of time to produce contractured conditions, for it is only after repeated reflex contractions that we have contraction remainder.

A continuous draft of air may give us a crick in the neck due to the continuous tonic contraction of the musculature of the spinal column in the cervical region.

Following a sprain of the ankle joint, wrist or knee, we have as the result of the local irritation, a spinal contraction affecting the integrity of the nerve supply to the injured part. Now this at first does not seem self-evident. We have repeatedly traced tender nerves to the spinal column from sprained ankles, sprained wrists, from abscesses, from boils, and from inflammatory zones in different parts of the body, and almost invariably find a contractured condition of the musculature of the spine at the point of the spinal origin of the nerve that supplies the zone of the lesion.

When there is congestion, throbbing, and other unpleasant symptoms as a result of a sprain, we may, by relieving the contractured condition of the spinal column at the point of the spinal exit of the nerve supply to that part, entirely relieve the nerve and thus relieve all symptoms and sensations of any pathological conditions or processes.

One case that called on the author for treatment bears evidence to the truthfulness of the above concerning reflex spinal lesions in the form of contractions causing impinged nerves. This case had suffered a fall of several feet from a bridge, and lighted upon a pile of rocks. One ankle was badly sprained and bruised. He was under the care of two physicians, who kept him under the influence of morphine for nine days on account of the severe pain. The pain, however, did not subside, and the patient could not rest, and claimed that he suffered all the time, notwithstanding the sedative effects of the medicine that had been administered.

He was slow to believe that we could affect the ankle by spinal treatment. In order to convince his mind to the truth of the connection existing between the peri-

pheral lesion and the ankle, we carefully traced a tender nerve from the sprained ankle to the lumbar region of the spine. The tenderness of the nerve was quickly determined, and the path of the nerve was easily followed because of the sharp tenderness felt by the patient when the nerve was palpated. The tender nerve emanated from the spine in the lower portion of the lumbar region.

A thrust was given to relieve the contractured musculature of the spine, and the relief was almost immediate. In a few seconds' time he mentioned there was a tingling in that ankle, but in answer to our question informed us that the pain had entirely disappeared. Subsequent palpation along the track of the tender nerve soon after the adjustment showed that the tenderness of the nerve had almost entirely subsided.

Some hot fomentations were applied to the ankle to relieve the paralytic condition of the blood vessels, or rather to assist the nerve supply in this relief, and the patient soon dropped off asleep. After three hours of perfect, absolute rest and deep sleep, he was awakened and sent home. The pain in the ankle did not return. Recovery took place rapidly, and the man returned to his labor and did not need further treatment.

Often members of a ball team will sprain an ankle or wrist, and many of them have learned, by taking spinal adjustment, that the spine had become involved as a result of the peripheral afferent irritation. A thrust applied to overcome contractions at the spinal origin of the nerves from whence comes the direct nerve supply to the zone affected, would almost always give them immediate relief. The aching, throbbing, congested, and uneasy feeling would subside almost immediately after removal of interference with or impingement of the nerve at the point of its spinal exit.

We have repeatedly demonstrated that there is a tender nerve existing and extending from all inflamma-

tory and painful lesions back to the spinal exit of the nerve supplying the point irritated. We have repeatedly proven that the pain existing in such cases was due to that contraction at the spinal exit of the nerve, causing a slight impingement of the nerve.

Any strong irritant to the peripheral endings of afferent nerves will excite the reflex conditions, and consequently produce spinal lesions—provided the irritative or exciting influence is of sufficient magnitude— and is continued for a sufficient length of time.

It is the excessive tonic contraction of muscles that produces the permanent shortened and contractured condition of them.

The toxins of pathogenic bacteria have a decided effect upon the sensory peripheral nerve endings. They excite, as noted above, the thermogenetic activity of the nerves affected. They also excite spinal contraction.

As a rule, infections will affect certain parts of the body. For example: Scarlet fever and diphtheria affect the throat tissues and muscles of the upper air passages involved. Typhoid fever affects the small intestines and the spleen.

When a bacterial infection of an infectious or contagious disease attacks its point of predilection in the patient, we will soon have the production of toxins. The effects of these toxins are very decided upon the sensory nerve endings in the zone of the affection. Spinal tenderness is at once evident. A close palpation of the spinal column will often determine the location, and consequently we may judge the nature of an infectious disease because of the zone of its habitat.

Catarrhal inflammation, or pneumococcus infection of the appendix, will cause a spinal contraction at the exit of the second lumbar nerve on the right side of the spinal column.

An infection of typhoid fever will, because of the

toxic excitation of the peripheral sensory nerves, cause contraction at two portions or segments of the spine: One point in the spine is where the principal nerves supplying the small intestines make their exit; while the other point of contraction is where the nerves supplying the spleen pass from the spinal neural canal.

In the case of diphtheria or scarlet fever, we find tenderness in the upper thoracic region corresponding to the origin of the spinal nerves which send white rami communicantes to the region of the throat.

It is possible to make a diagnosis of a contagious or infectious disease by spinal palpation, provided we understand how and where the toxic effects of the germ products of the different diseases produce reflexly the spinal lesions by reflex contraction. The author remembers a case that came into the office, that will illustrate this point: It was a former patient, who came for consultation, and she was suffering with a high fever. Being acquainted at our office, she went at once to the treatment room and dressed herself for spinal examination.

Palpation of the spinal column elicited tenderness at the point of the spinal exit of the nerve supply to the spleen, and also at the point of exit of the nerve supply to the small intestines. After a careful palpation of all other portions of the spine with negative results, a diagnosis of typhoid fever was made. A subsequent inquiry into the history of the case, developed unmistakably that the diagnosis was correct.

We have often diagnosed appendicitis by reason of a knowledge of the reflex effects upon the spinal column that result from the disease when in a painful or inflamed condition.

We are confident that no inflammatory or infectious zone can exist anywhere in the body without producing perceptible results upon the spinal column. Persons

with trained fingers and brains will verify the truthfulness of this statement in any case.

Atmospheric Influence.—For a long time we have known that before approaching storms and before changes in the weather, and especially before rains and stormy periods, almost all rheumatics increase their complaining. Some people are very good barometers of the weather. Did you ever wonder why this is so?

Undoubtedly there is something in the condition of the atmosphere, in the moisture, or in the electric condition thereof, in the position of the planets, or something else, that has an influence upon the muscles, ligaments, and tendons of the spine. Something of this nature must account for the changes which take place in the patient's condition—especially rheumatics—just previous to a storm. There is something in the atmospheric condition surrounding the patient that is responsible for the change in the contractility of the musculature of the spinal column.

There is a manifest difference between the atmospheric condition during the day, and that during the night. Ordinarily, a patient will suffer more at night than in the day time, from the unfavorable symptoms connected with different forms of disease, acute or chronic. Patients usually complain that the pains are worse at night than in the day time. One reason for this is, that the patient becomes quiet at night and is liable to forget his work and to think only of his trouble. This will magnify the pain, and this is, no doubt, the reason why the patient is more sensitive to, and suffers with pain more, at night.

When the mind is drawn entirely away from the pain, or from the cause that produces it, we feel but little pain, but if we are expecting pain, the mind is centered upon it, and the pain will be intensified. There is no doubt of the truth that pain is in many cases really worse at

night because of atmospheric changes, as well as worse before certain changes in the weather.

There is another feature concerning the attitude of the patient during the night, that tends to give relief. The rest and relaxation of the spine tend to relieve interference with nerves, because of the tendency to overcome the settling of the previous day. As a result of the night's rest, our patient will feel better in the morning, usually.

Undoubtedly during the night, and preceding electrical storms accompanying falling weather, the unfavorable symptoms connected with our patients are due to some change in the amount of electricity, moisture, or temperature of the atmosphere around us, which affects the nervous system and the musculature of the spinal column.

The effects must produce some contractions of these tissues that will slightly increase a partial impingement, and consequently increase the pain of a nerve that is already slightly impinged.

Influence of Altitude.—I have observed that in different altitudes there were differences in the spinal condition of patients. In mountainous regions in consequence of the atmospheric conditions, there is produced a perceptible change in the tonicity and tension of the articular ligaments and other muscular tissues of the spinal column.

In giving spinal adjustments to patients in mountainous regions, I find that on an average it takes a more forcible thrust to open up the spinal articulations, than is necessary in regions nearer the sea level.

The skin does not act so freely in the cooler mountain regions, as it does in the warmer and more humid atmospheres; hence, perspiration is much less in quantity. We have noticed, also, when visiting in mountain regions, that we seldom perspire in perceptible quantities. The

failure of skin action in mountain regions becomes a direct cause of excessive elimination through the kidneys, and consequently kidney overwork, with a resulting derangement of kidney function and disease.

In making examinations of a number of cases in a doctor's office in Trinidad, Colorado, I found the great majority of patients suffering with kidney disease, which was undoubtedly due to the failure of sufficient skin action and consequent excessive kidney action. We have also found in giving adjustments, that the spines of patients in high altitudes were stiff and unflexible—much more so than the spines of patients in lower altitudes. This was evidently because of the tonicity, tension, and contractured condition of their spinal musculature.

The bearing that these spinal contractions have upon the pathogenic processes, will be considered under the subject of Etiology. In this chapter our only consideration is that of spinal lesions from reflex contractions, and this, we believe, will present an entirely new thought to most practitioners of the healing art, and we hope that others may be induced to investigate more fully along this line, and will help to give to the world some new light concerning interference with nerve supply, its causes, and its relation to abnormal function and disease.

We further trust that this thought will lead to a more persistent study and practice of methods of spinal treatment for the removal of interference with the normal nerve supply, and for the restoration of normal function and health. This can be most successfully accomplished by spinal treatment methods that cause a relaxation of the spinal musculature. We should be sufficiently broad-minded to make use of the thrust and any auxiliary method of spondylotherapy or other methods of treatment that may prove efficient and practicable.

CHAPTER VIII.

RESULTS OF SPINAL LESIONS.

THE results of spinal lesions are an important consideration for us, as well as the cause of spinal lesions, for the reason that spinal lesions are the causes of interference with the spinal nerves and consequently the cause of the derangement of function, existing or manifest, in all forms of disease, both acute and chronic.

When we have any contraction of the spinal musculature, and consequent interference with impingement of the nerve sheath, we may have one or more of a number of different things interfered with. We enumerate below the principal tissues that may become interfered with, in the performance of their normal function, as a result of an impingement of the neural sheath which contains them, where it passes through its intervertebral foramen, that has been narrowed by a contraction of the musculature of a segment of the spinal column. We enumerate what may be impinged as follows:

I. Afferent nerves.
II. Efferent nerves.
III. Veins from cord.
IV. Arteries to cord.
V. Gray rami to cord.
VI. Lymphatics to cord.
VII. White rami to sympathetic.

Many in the study of spinal lesions see or mention but one anatomical formation that can be interfered with by the narrowing of an intervertebral foramina, namely, the nerves, but from the above enumeration we see that a number of things are contained in the neural sheath, and that they may, therefore, become involved as the result of impingement of the nerve sheath.

Illustration showing how the nerve sheaths make their exit from the spinal column, or the neural canal, and how they vary in size owing to variation in the size of the foramina, which is due to muscular contraction along the spinal column. (Courtesy O. W. Lindstrom.)

I. Afferent Nerves.—The afferent nerve fibers that are in the nerve trunk and passing through the foramen in the nerve sheath, as they pass from their peripheral termination to the reflex center in the spinal cord, may be interfered with by impingement of the nerve sheath, caused by a narrowing of the foramen. Interference with these fibers will interfere with the condition of the afferent nerve impulses, and consequently with the reflex motor action that would be normally produced in the tissues supplied.

II. Efferent Nerves.—Interference with the efferent nerve fibers will impede the transmission of centrifugal impulses, and consequently with the work done in tissues supplied by their end organs. As a result, we have deranged function, which is disease.

III. Veins from Cord.—Veins passing out through the foramen from a spinal segment in the nerve sheaths drain that segment of the spinal cord, and when they are interfered with by being occluded partially, or completely, we will have more or less congestion of the spinal segment which they should drain, and the unfavorable effects and the influence of the toxic elements of the venous constituents will cause a deranged condition of the function of the spinal segment. This will alter all afferent impulses that are reflexed therein.

IV. Arteries to Cord.—The arteries that pass into and supply a spinal segment through the foramina and contained in the nerve sheaths, will furnish nutrition to that spinal segment. Any occlusion or impingement of these vessels will cause an anæmic condition, and thus interfere with the function of the spinal segment or center by decreasing or destroying the excitability of that spinal center, and of the nerves coming from that segment of the spinal cord. This condition will destroy the continuity of the reflex path through the spinal center.

V. Gray Rami to Cord.—The gray rami communicantes also pass to the spinal cord contained in the nerve sheath into the neural canal, in connection with the afferent and efferent nerve fibers, and they supply the relative spinal segment. The gray rami control the processes of metabolism in this spinal center and are essential to its cellular integrity and functional activity.

VI. Lymphatics to Cord.—The lymphatics that ramify and supply the spinal cord also pass in through the intervertebral foramina in the nerve sheaths to the segment they supply; consequently any impingement of the nerve sheaths will interfere with the lymphatic supply to the spinal segments and alter the emanation and transfer of all impulses.

VII. White Rami to Sympathetic.—As the white rami communicantes are also contained in the nerve sheaths of the spinal nerves, they may be interfered with by impingement of the nerve sheaths, as they pass through the intervertebral foramina. Any interference with the white rami communicantes which communicate with the sympathetic ganglia, will deprive these ganglia of their normal physiological nerve impulse supply which is originated in the spinal cord or brain centers, and any interference with the transmission of the physiological impulse supply that is continually being received by the sympathetic system, will interfere with the integrity of its automatic action.

From interference with the circulation alone, we may have functional derangement of the nerve supply from the segment of the spinal column, whose circulation is interfered with. A congested condition of this spinal segment will alter the reflex impulses as they are transferred from the afferent to the motor efferent nerves, and will also alter the physiological impulses originating in the nerve centers, and as a result of this functional

derangement, we have disease and histological alterations.

There is one favorable phase of this derangement of the circulation, and this is, if the circulation supplied to one segment of the spinal cord is interfered with we may have established, by means of capillary anastomosis, a compensatory circulation from adjacent segments of the spinal cord. For the above reasons, functional derangement, which is the result of interference with the arterial supply or the venous drainage of a spinal segment, may disappear as soon as the collateral circulation is developed by anastomotic branches.

When we have nerve impingement, we will have another and entirely different condition of affairs. In the first place, nerves do not anastomose like blood vessels where one is cut; neighboring nerves do not enter into and supply the same zone.

Any mechanical impingement of nerves excites pain. An impingement of sufficient amount to interfere much with the function of the nerve, will always be indicated by the excitation and existence of pain, except where impingement has continued for a sufficient length of time, and is of sufficient severity, to paralyze the nerve that is impinged.

We are always able to determine as to whether functional derangement is the result of nerve impingement or is the result of interference with the circulation, by the presence or absence of pain. As a result of interference with nerves, lymphatics, arteries and veins, we have derangement of function but the absence of any pain. In case of impingement of nerve we have not only the manifest derangement of function, but also the existence of pain, unless there is a condition of lack of excitability or paralysis of the nerve subjected to slight pressure or to mechanical interference.

AUTOPROTECTION.

Because of spinal lesions, we find a certain train of conditions engendered which constitutes the predisposing cause or condition permitting the invasion of acute disease, and causing functional derangement that leads to the development and a continuation of chronic disease.

As a summary of the results engendered because of nerve interference, we enumerate the following:

Lack of:
- I. Autoprotection.
- II. Normal tonicity.
- III. Normal circulation.
- IV. Normal metabolism.
- V. Normal recuperation.
- VI. Normal thermogenesis.
- VII. Histological conformation.

I. Lack of Autoprotection.—Autoprotection means self-protection, and if we lack autoprotection, we are unprotected against the invasion of disease.

If autoprotection is sufficient, we will be invulnerable to both contagious and infectious disease, although we may be exposed to them.

If autoprotection is below par, then we will fall a victim to almost any infectious or contagious disease to which we may be exposed. Although our general health may be good, we may fall a victim to any contagious disease that may invade a local zone in our organism, where our autoprotection is deficient. Lack of autoprotection denotes a general lack of vital activity and vital cellular resistance, all of which is due to an interference with nerve supply and functional activity.

II. Lack of Normal Tonicity.—Tonicity depends entirely upon nerve supply and nerve function. Any interference whatever with the nerve function, because of interference with the nerve's excitability or conduc-

tivity, will lessen the tonicity of the tissues in the zone supplied. Any interference with nerves, either because of impingement, nutritive alteration, or mental impression, will alter the functional action of the nerves, and alter the tonicity of the tissues supplied.

The lack of tonicity of the musculature of the spine is a permitting cause of spinal settling. Spinal settling will cause a slight anæmia of the spinal cord, and an irritability, and all the untoward symptoms that arise from this condition will follow.

III. Lack of Normal Metabolism.—Metabolism means the processes of nutrition and building up or constructive changes of the cellular tissues of the body, and also the processes of elimination of the ashes of combustion, so to speak, or of the by-products of functional activity.

Metabolism, like tonicity and autoprotection, depends wholly upon the integrity of the nerve supply and function. If the nerve supply to any one portion of the body is cut off, as, for example, the one limb of a child, it will prevent the trophic phase of the metabolic processes, which will result in non-development.

If, in later life, a person by some accident, or as a result of some spinal lesion, suffers interference with the nerve supply to the upper extremity, that extremity will waste away, due to the cessation of the normal trophic processes of metabolism.

Internal secretions have an important influence upon the processes of metabolism, but the secretion of the glands giving off internal secretions which are thrown into the blood channels direct, is the result of nerve function, and especially of the physiological nerve impulses transmitted over the nerves to the internal secreting glands.

Any interference with the nerve supply to any of the glands producing the internal secretion, will directly

interfere with the processes of metabolism throughout the entire body.

IV. Lack of Normal Circulation.—Lack of normal circulation is a direct result of an interference with the vasomotor influences of the nerve supply. Nerves control the circulation in all parts of the organism through their influence upon the walls of the circulatory system.

Nerve impulse controls the contractions of the heart, and also the dilatation and constriction of the arteries and the valves of the veins, as well as the muscular walls thereof.

A lack of tonicity of any part of the circulatory apparatus, more especially in the capillary portion, tends to induce a condition of stasis. A sluggish condition of the circulation in any zone invites the invasion and development of infectious disease.

By spinal treatment we have a direct effect upon the vascular system. Varicose veins of the lower extremity, as well as dropsical conditions from a weak heart, are readily overcome by restoring the normal nerve supply and vascular tone to the lower extremities and to other portions of the human anatomy.

V. Lack of Normal Recuperation.—Our recuperative power depends wholly upon the efficiency of the nerve supply. It is impossible to recover from disease or from operative procedures, unless we possess recuperative power. Normal recuperative power is necessary that recovery may occur in a normal manner from any pathological lesions.

In order to have this, we must have normal circulation, normal tonicity, normal metabolism, and all other conditions engendered by normal nerve supply and normal nerve impulse.

We have treated patients who had suffered with ulcers for years, and healing of them would take place in a

short time when interference with the nerve supply was removed by spinal adjustment.

We are brought to the inevitable conclusion after watching the result of spinal adjustment, that the recuperative power and the power of restoration, are maintained by, and depend upon, the integrity of the nerve supply and nerve function.

VI. Lack of Normal Thermogenesis.—Lack of normal thermogenesis is also the result of interference with the normal nerve impulse, normal vital processes, and normal metabolic processes, all of which are dependent upon nerve function.

If the nerve supply to the arm is interfered with, that arm and hand will be cold, not so much because of the lack of circulation, but because of the lack of the vital processes that should be maintained in the arm and hand. The nerve supply and function, however, that will establish the normal vital processes and normal thermogenesis, will establish and maintain the normal circulation.

The loss of heat is all controlled by nerves.

Our skin action is controlled by nerves.

Perspiration is controlled by nerves.

Metabolism is controlled by nerves.

We conclude, therefore, that the process of both heat production and heat elimination is directly under the influence and control of the impulses of the nervous system.

VII. Lack of Histological Conformation.—The cellular arrangement is another matter that depends wholly upon nerve action. The process of metabolism controlled by nerve supply, is responsible for the maintenance of cellular structures in their perfect condition.

Both the trophic function controlling the building up process, and the growth of the cells of the body, and also the eliminative processes, are under the control of the nerve fibers that control the cell growth and development.

Any interference with the circulation will interfere with the nourishment, and consequently the trophic supply of the nerves and also with all cell growth and cell multiplication.

Any interference with the eliminative processes will prevent the metabolic process of cleansing and prevention of degeneration of the cells. The perfect nerve supply, however, will prevent derangement of cellular structures, while a derangement of function will engender cellular derangement.

In our study of the subject of nerve interference, we learn that the function of nerves may be altered in several ways:

1. Excitability of nerves may be increased.
2. Excitability of nerves may be depressed.
3. Conductivity of nerves may be increased.
4. Conductivity of nerves may be decreased.
5. Reflex centers of nerves may be too excitable.
6. Reflex centers of nerves may be benumbed.
7. Efferent transmission of impulse may be altered.

If the terminal end apparatus of afferent nerves are tender, or sore, or their excitability is increased, then will the ordinary stimulus produce more than an ordinary excitation and impulse.

If the excitability of the nerves is depressed, the normal stimuli will not cause or incite the normal amount of impulse.

The impulse excited, then, depends upon the state of the excitability of the nerve, and any deviation from the normal condition of excitability will cause a corresponding deviation in the quantity or magnitude of the impulse excited by the stimulus.

If the conductivity of an afferent nerve is increased, the impulse may be increased while being transmitted.

If the conductivity of an afferent nerve is depressed,

then the impulse may be diminished during the transmission to the reflex center or brain.

Any alteration of the conductivity of an afferent nerve will alter impulses that are transmitted according to the derangement of the conductivity.

The condition of the reflex centers in the spinal cord or in the brain, may be altered because of anæmia or because of any other pathological condition. In such case we do not have the normal generation nor emanation of the physiological impulses from the nerve centers.

The impulse that is received as the result of a stimulation of afferent nerves and carried to the reflex centers of the cord, are not transferred perfectly by the reflex centers which are depressed; or, they are magnified if the reflex center is in an excitable condition. The percentage of loss or of gain in the reflex center is proportionate to the pathological derangement of the functional action of the reflex centers.

Suppose there is a stimulation of an afferent nerve. Now, if the excitability is normal, a normal impulse will be generated, but if the excitability varies from the normal, there will be a like variation of the volume of the impulse that is engendered because of the stimulation.

Suppose that only half of the normal impulse is generated from a stimulus because of the lack of excitability of the end apparatus of the afferent nerve, we can then have but half of the normal impulse for transmission to the reflex center which is in the gray matter of the spinal cord, and although the reflex act and conductivity is normal, we have but fifty per cent of a return impulse for transmission over the efferent route.

If the excitability of the afferent nerve is normal, then the impulse engendered by stimulation will be normal also, provided it is not altered in afferent transmission or in the reflex centers.

If the efferent nerve is in any way interfered with the impulse may be altered, either increased or diminished during the efferent transmission in proportion to the alteration of the function of the efferent nerve.

CHAPTER IX.

ETIOLOGY.

ETIOLOGY is a treatise of the cause of disease. We are interested in the subject of etiology in this connection for several reasons:

One of the more important reasons is that up to the present time there are many questions unanswered as to the cause of disease, in ordinary works written on the subject of etiology.

We cannot obtain from our medical literature an explanation of why one person will suffer with chronic asthma while another does not.

Why one person is afflicted with hay fever, and why others are not.

Why one person suffers with chronic rheumatism and why others do not.

Why, in many cases, some will suffer with indigestion or some of the different forms of dyspepsia, while others are not troubled in this way.

In fact, a great many questions like this, as to the etiology of chronic disease, are as yet practically unanswered by practitioners of the orthodox schools of medicine.

Some advancement has been claimed by recent writers who have studied the question of autoprotection, as to a knowledge of the etiology factors, but no satisfactory means have been discovered for production of the functional efficiency of cellular tissues or agents that will enhance the necessary autoprotection sufficient to prevent the invasion and existence of acute and chronic disease.

We may consistently ask the question why one person will take typhoid fever while another does not; why part of a family of brothers and sisters, while living under the same conditions and eating of the same diet, and

consequently suffering the same exposure to infection, will succumb to typhoid while other members of the family do not.

We might roughly say that the reason why the above is true, is because the autoprotection is sufficient in one case to prevent the invasion of disease, while in the other case there is a lack of sufficient autoprotection, which rendered the zone of predilection of the typhoid bacilli vulnerable to their invasion and development of this disease.

We should go still further in our answer to this question, and state why the autoprotection is low in the one person, permitting the invasion and development of disease, while it is efficient in other cases, preventing the invasion or development of the typhoid bacilli and the consequent development of disease.

The same question may be asked concerning why some children are victims of different contagious diseases, and others, under like conditions and enjoying apparently the same health, go free.

Again, the question arises: Why some children, who are enjoying apparently perfect health, will fall victims to a certain infectious disease, while others enjoying a less perfect condition of general health, will go free.

All the above questions we believe can be satisfactorily answered, and we hope that the reader of this work will be intelligently satisfied in his own mind as to the answer to the above questions, after he has studied this work chapter after chapter.

We are aware that a great advancement has been made in the study of pathology and in the study of pathological agencies during the past few years since the invention of the microscope. The painstaking study and experiments of our eminent pathologists have given us great light on many subjects. By means of the microscope we have learned of the existence of germs. In our

pathological laboratories we have studied and demonstrated that they are important etiological factors in the production of all infectious and contagious diseases. As a basis for our study of the subject of etiology, we accept the ordinary classification, namely:

1. Exciting causes.
2. Predisposing causes.

EXCITING CAUSES.—We will consider for a moment some of the more important classes of exciting causes of disease, and begin our consideration by making an enumeration of the principal exciting causes under the following:

I. Exposure.
II. Infection.
III. Traumatism.
IV. Errors of diet.
V. Errors of exercise.
VI. Poisonous medicines.
VII. Poisonous food stuffs.

Under the headings above we have enumerated what we believe to be the principal exciting causes of disease.

I. EXPOSURE.—It is a well-known fact to any intelligent person who has given the matter any thought, that exposure to cold or to extreme heat or exposure to dampness and moisture, will induce colds, and, as a result of failure of elimination, sometimes rheumatic affections and pneumonia. Many a person has lost health from exposure, many can attest the truthfulness of the statement that exposure is a direct cause of pathological conditions of disease.

There is no doubt that some may be subjected to more exposure than others without being apparently affected thereby. The general condition of the patient may be sufficient in some cases to withstand considerable exposure of different kinds, while with others the conditions are such that much less exposure will induce different pathological conditions. It is an evident fact,

however, that exposure is an exciting and direct cause of much disease, hence we pass this subject without further comment.

II. Infection.—When the microscope first revealed the existence of germ life, and when infection first began to be understood by the scientific students of our day, to be etiological agents, there were a number of M. D.'s that scoffed at the idea. When the claim was set forth that these infections were the cause of infectious and contagious disease, it was disbelieved by all of the less informed, and especially those who had never had the privilege of looking at the prepared specimens of bacteria through a microscope.

As the years rolled by, and as more light has been thrown on the subject of etiology, by investigation of the subject of infection and its connection with disease as an etiological factor, practically all of the medical profession, because of further investigation, have finally accepted the truthfulness of the theory that infection is an exciting cause of disease.

We are surprised that some are still in the dark in a great measure. Among those denying that germs are etiological factors are recent self-styled discoverers and developers, who claim that germs have nothing to do with the production of disease.

Every intelligent person knows that it would be impossible to catch mumps if one were not exposed to them. It is also absolutely impossible to catch measles, whooping cough, scarlet fever, diphtheria, smallpox, or any other of the contagious diseases, without being in some way exposed to the infection or the bacteria that is the direct and absolute cause of them.

The relation of bacteria to the etiology of disease has been studied in a very careful way. Before a specific germ has been recognized as the cause of a specific disease, it must comply with four laws. In studying the

germ that is the cause of any special disease, its behavior must conform to the following:

1. The specific germ is always present.
2. This germ must be grown in a pure culture.
3. The cultured germ must produce the same disease.
4. This specific germ must be found in the produced disease.

Now if the specific germ conforms to these four laws, it is considered proof that this germ is the exciting cause of the disease in question. One law of germ life is that they do not originate *de novo.* For this reason contagious diseases are not and cannot originate except from exposure, directly or indirectly, to that specific infection. Take the following example:

Suppose that twenty children visit a Sunday school and one of their number is breaking out with measles. A number of the children present will become inoculated, and after a period of incubation they will suffer an invasion or attack of measles.

Suppose at another point twenty children gather at school but none of them have measles, then we would know that none of these children would take measles. For a child to become infected, exposure to an infection is necessary, hence the infection is the exciting cause.

Now, on the theory that nerve pressure is the cause of all disease, as is claimed by late philosophers, (?) we would be led to the conclusion that the first group of children had nerve pressure, while the last group did not.

We know that sometimes a person may be exposed to a contagious disease and not take it, but that does not prove that the infection to which he was exposed will not produce and cause that specific disease, if the conditions in the patient are favorable, because of the lack of autoprotection.

It is autoprotection, or the lack of autoprotection, that accounts for the difference, and explains why one

will, and one will not, become infected with any contagious disease to which they may be exposed.

It may not be apparent to some how we may be able to affect, by spinal treatment, diseases that are caused by an infection. In this connection, we call attention to the fact that the invasion of disease is permitted by or is due to the lack of autoprotection. Lack of autoprotection is due to interference with the function of nerves. If we remove all interference with the nerve supply to the zone of the infection, and in so doing stimulate that nerve supply, we will establish that autoprotection that will prevent the further development of the infection, and a return to the normal will follow.

Should we, on the other hand, try to destroy the infection by the administration of drugs, we will find it impossible to administer medicine that is sufficiently toxic to act as a bactericide without poisoning and destroying the patient.

III. Traumatism.—The word traumatism refers to wounds, and may refer to wounds of any nature, as cuts, bruises, fractures, dislocations, etc. When cellular tissues are deranged or altered their normal nerve supply cannot produce normal function therein. The cutting or bruising of a nerve will destroy its action and alter the function produced by the nerve.

Many traumatic wounds are very severe, causing instant death. As a result of bruises, some people will have boils, carbuncles, etc. Traumatic wounds are evidently not the result of nerve impingement but of accident.

IV. Errors of Diet.—Probably one of the most common causes of derangement and disease, is error of diet.

(1) One of the most common errors of diet is probably excessive eating.

(2) Another very common dietetic error is eating at railroad speed.

(3) Another dietetic error is eating wrong food combinations.

(4) Still another dietetic error is eating foods containing toxins as a result of decomposition.

There is no doubt we have some nerve interference in certain regions of the spinal column in connection with all disease. In the case of digestive derangement there is no doubt but what we have some impingement of nerves that supply the alimentary tract, especially the gastric region, but in this connection, allow me to say that nerve pressure is not the primary cause of any disease. Nerve pressure is always the result of exciting causes.

We do not believe it necessary to make any further remarks on the subject of dietetic errors being the cause of disease, as we feel it is a recognized etiological factor by all intelligent and thinking people.

V. Errors of Exercise.—An error in the amount of exercise that is regularly taken is another cause of disease. Excessive exercise may engender untoward effects in different ways:

First, the athlete is prone to suffer hypertrophy of the heart as the result of over-exertion. Excessive exhaustion from overwork produces muscle tire; consequently general hypo-tonicity of the musculature of the spine, which leads to undue settling.

Over-exercise, however, is not the cause of as much trouble as is insufficient physical exercise. Some of the most stubborn cases, and some that we could not get results with by treatment, were those that would give up and lie in bed. A well person who will lie in bed continually, will lose his strength and so be brought to death's door. We have known of people lying in bed and eating three meals a day, having their meals brought to them because they felt dizzy when getting up to walk.

We cannot regain nor maintain any muscular strength while continuing in a state of inactivity. An athlete preparing for a contest would never expect to gain strength by lying still. The internal organs become sluggish; the vascular system becomes weak, and a general retrograde series of changes takes place in the person who allows himself to remain in bed, and dissolution is the inevitable result. People of sedentary habits are prone to become neurasthenics, dyspeptics, and to suffer with insomnia.

VI. Poisonous Medicines.—That the use of strong medicines is detrimental in many cases and will do harm, is the firm belief of the author, and it is also the belief of many learned physicians. In fact, our best physicians do not wish to take their own medicines, nor want their families to swallow much of the stuff that is given out from our apothecary shops.

"It is my firm belief that the prevailing mode of practice is productive of vastly more evil than good, and were it absolutely abolished, mankind would be infinitely the gainer."—Dr. Cogswell, Boston, Mass.

This statement from an eminent authority is worthy of consideration. Many other eminent physicians have made similar statements concerning the modern use of drugs. Prof. Jamison, of Edinburgh, says: "Nine times out of ten our miscalled remedies are absolutely injurious to our patients."

We are sure that there is truth in these statements and we want to enlighten the people who read this article as to some ways in which drugs produce injurious results when taken at the suggestion of a member of the laity and as per the routine dosage of regular medical practitioners.

It is an undisputed fact that the constant use of cathartic medicines will sooner or later cause a persistent chronic constipation. We are confident that nine tenths of all cases of chronic constipation may be traced back

to the habit of taking pills or some other cathartic or laxative, as is the habit of many people who are educated to do so by their parents or by the medical practitioner. A person is many times worse off after becoming a pill fiend, or after taking cathartics, than if he had never fostered such habits and induced conditions which will always result.

Morphine is often taken for the relief of pain, until that baneful habit of morphinism is engendered. But while taking morphine for the pain, we are increasing the excitability of nerves to the sensibility of pain, and thus producing a condition of our nervous system a thousand times worse than if we had never used that harmful drug.

Morphine to-day is known to be one of our greatest curses because of its baneful effect. This morphine habit is worse than drunkenness. It is an accursed habit—a vice that soon becomes a nervous disease, destroying the equilibrium of the mind, and destroying the will power and moral character of the patient.

Unfortunately the making of morphine victims goes on steadily, and the doctors are originally responsible for nine out of ten of these drug victims.

Strychnine is to-day the Samson of materia medica, and is given almost for everything. It greatly stimulates all the functions of the body because of its general effect upon the entire nervous system. Strychnine has a direct action upon the tendons and other tissues of the spinal column, causing their contraction, and producing a contractured condition of the spinal column, which is incompatible with good health.

An overdose of strychnine produces fatal results or death, by the extreme contraction of the tissues of the spinal column, causing a drawing backward of the head and lower extremities, and an arching forward of the vertebral column into a condition of opisthotonos. When the spine is bent forward in this manner, it

narrows the intervertebral foramina, impinges the nerve sheaths, and cuts off the nerve supply to the lungs, heart and all vital organs, and thus produces death.

In lighter doses we have the same effects produced in a less degree. A slight narrowing of the spinal foramina excites the spinal centers, the action of them is increased at the expense of their freedom and normal condition. The stimulating or exciting effects of strychnine, which are caused by slight interference with nerves because of a slight narrowing of spinal foramina, will, as a secondary result, impair the action of nerves in proportion to the amount of interference. Strychnine will leave its mark on the spine which is manifest in the condition of its musculature.

Digitalis is a commonly used remedy in functional heart troubles. It is often accumulative in its effects, and produces harmful, and sometimes fatal results. Decided cheynestroke respiration is a common result of the use of digitalis.

We feel confident that the most healthful person who may habitually use strychnine or digitalis will sooner or later die of heart disease.

The constant use of medicines that stimulate and irritate the kidneys will induce derangement of these organs, and if the kidney remedies are persisted in, they will ultimately cause death from kidney disease.

Many, many cases of stomach trouble are directly due to the use of strong medicine, and many cases will improve when the use of drugs is discontinued.

Many patients have told me that they had quit the habit of taking drugs, and that they were enjoying an improved condition of health since doing so. Ask any well-informed and honest M. D. as to the correctness of the above, and he will tell you 'tis too true.

So, in conclusion, we will give the following recipes for the production of diseases:

1. Hypnotics, to produce insomnia.
2. Cathartics, to produce constipation.
3. Digitalis, to produce heart trouble.
4. Morphine, to produce sensitiveness to pain.
5. Kidney medicine, to produce kidney disease.
6. Strong medicine, to produce stomach trouble.
7. Headache powders, to produce the headache habit.

VII. Poisonous Food Stuffs.—We may have poisonous food stuffs resulting from decomposition, and we may use narcotics and alcoholic drinks which will become, by their use, etiological factors.

Persons sometimes, after eating canned fruits, are poisoned thereby. We may eat flesh containing animal parasites, especially the tapeworm and the trichina. It is estimated that practically one out of every fourteen hogs is infected with trichina. For this reason American pork is excluded from some of the European countries.

The habitual use of beer lowers autoprotection, and also decreases the power of recuperation. When beer drinkers are overtaken by a contagious disease, by pneumonia, or by any other disease, they more readily succumb than those who abstain. Alcoholic drinks will also cause disease of the liver, stomach, and kidneys.

In the case of food containing poison, or containing animal parasites, or in the use of tobacco or alcoholic drinks, we cannot possibly lay the disease engendered at the door of nerve impingement as the cause. On the other hand, the nerve impingement that exists in such cases, or, more correctly speaking, the nerve interference, is not the cause, but the result of the use of these detrimental and poisonous food stuffs, and the reason of the involvement of the spine in such cases is explained in previous chapters.

CHAPTER X.

ETIOLOGY—Continued.

PREDISPOSING CAUSES OF DISEASE.

A PREDISPOSING cause, strictly speaking, is a permitting or vulnerable condition existing within the animal organism.

The term autoprotection means a vital condition that enables the tissues to resist the invasion of disease, while lack of autoprotection would be synonymous in meaning with the term predisposing cause, and refers to that lack of vital resistance which will permit the invasion and development of the bacteria of infectious and contagious diseases.

The nervous system is the agency of the production of all function within the body; therefore all vital resistance, autoprotection, or lack thereof, is directly due to the condition of the nerve supply and nerve function.

The predisposing cause is necessarily present, that the exciting cause may be enabled to invade and develop pathological processes. For this reason the predisposing cause, or lack of autoprotection, is a most important subject of consideration from a prophylactic standpoint.

Any condition or agency that removes the predisposing cause of disease or that establishes normal autoprotection, becomes at once the most important factor and consideration in the prevention of disease, while any agency that will produce the opposite condition is directly responsible for the inroads and development of infectious and contagious disease.

The predisposing cause is responsible for the derangement of function, or lack of vital function, which exists in all chronic forms of disease, and is also the cause of the continuation of chronic disease.

Predisposing cause is not a primary cause but is a secondary cause, being the result of agencies or influences that interfere with the nerve supply and nerve function that is necessary for the production of normal vital resistance. Nerves are responsible for the performance of all function, and it is interference with nerve supply that causes derangement of function, and it is ordinary spinal lesions that usually and primarily cause nerve interference; therefore we are carried back in our study of etiology to those agencies that result in spinal lesions and spinal interference with normal nerve supply.

For example: Let us study briefly the etiology of typhoid fever. That we may comprehend more fully the principles laid down in this chapter, we consider the ordinary infectious disease of typhoid fever.

The question might be asked, as above, why in a family of several members, part will succumb to an invasion of typhoid, while others go free. Now the answer that we would ordinarily make to this is that the vulnerable condition of the alimentary tract is the permitting cause of invasion in the ones who succumb to this disease, and a sufficient amount of autoprotection is the protective agency in case of those who did not become infected with typhoid.

Now the responsible agency in the production of the normal autoprotection that caused part of that family to escape typhoid fever, is due to a normal nerve supply and a normal supply of the physiological impulses or life force conveyed to the part by the efferent motor nerves and normal vital cellular activity and resistance.

It is very evident that lack of autoprotection in those who succumb to this disease, is directly due to some interference with the normal functioning and cellular activity or vital resistance of the zone that becomes infected, and this condition is due directly to some interference, that is cutting off the normal impulses which

would produce the normal autoprotection and prevent the invasion of the disease. Therefore, the consequent lack of autoprotection, or predisposing cause, is that favorable condition to the invasion and development of the bacteria exciting pathological processes which engenders the toxins that excite the fever.

Persons in general health may be in apparent good condition, and yet vital resistance or autoprotection in the small intestines where the typhoid germ invades, may be below par, and notwithstanding the apparent good health of the patient, he may fall a victim to the invasion of the typhoid bacilli, and a consequent victim to typhoid fever.

On the other hand, a person who is not apparently in robust health may have sufficient autoprotection in the alimentary tract to resist the invasion and development of the typhoid bacilli, and this person may go free. It is the autoprotection in the local zone of predilection of the typhoid bacilli that is necessary to prevent the invasion of this disease.

This is also true of all infectious and contagious diseases. The autoprotection that resists the invasion of disease is not dependent so much upon the general condition of the system, as it is upon the condition in the special zone of predilection of the specific infection.

The conditions and reasons for invasion of typhoid fever as given above, are similar to those existing and permitting the invasion of any of the infectious and contagious diseases. Any agency or any condition lowering the general vitality, or lowering the autoprotection of any specific zone, will induce that predisposing cause of disease, or a lack of autoprotection.

Any of the nerve depressants will induce the predisposing cause of disease, or cause the lack of normal autoprotection. Any of the exciting causes of disease will affect the condition of the musculature of the spine,

and consequently cause interference with nerve function, and in doing this, they engender the lack of autoprotection. Autoprotection means health, while the lack of normal autoprotection permits the possibility of the invasion of disease.

PAIN

THE subject of pain has been much discussed. We feel that new ideas concerning the cause and the best method of relieving pain, and other phases of this subject, justify a little space given to this subject in this connection.

There are five questions we may answer about pain:

1. Definition.
2. Where excited.
3. Where produced.
4. Where referred.
5. Where it exists.

Definition.—Pain is the cry of an injured nerve.

Pain may be defined as an interpretation, made by the brain, of an afferent impulse which is produced by an irritation or an injury of a nerve trunk or afferent nerve fibers. Any spinal lesion that causes nerve interference does so by an encroachment upon the integrity of the nerve sheath, where it extends from the neural canal through the intervertebral foramen.

As stated above, this interference may cause either vascular occlusion or nerve impingement. It is in the case of the more extreme contraction of the musculature of the spine that the nerve becomes impinged. This is due to the fact that the nerve is more resistant and maintains room for itself at the expense of the veins, arteries or lymphatics. If, however, the narrowing of a foramen is of such an extent as to impinge the nerve, we will then have the sensation of pain.

Now pain might be defined as being the cry of an injured nerve, and in this definition we differ from our former teaching, in which we were told that pain was the cry of a hungry nerve.

The author has fasted seven days and has had the watch care of a patient who fasted seventy days, and others who fasted thirty to forty days, and in no case has there been any pain present after the first few days of the fast. The experience we have had with fasting proves conclusively to our minds that pain is not the cry of a hungry nerve. On the other hand, we are as firmly convinced that we are correct in our new definition of pain, namely: That pain is the cry of an injured nerve or that pain is an interpretation of an afferent impulse from nerve irritation or traumatism.

II. Where Excited.—Pain may be excited anywhere a nerve is injured. A nerve fiber is often irritated and excited from traumatic agencies affecting the end apparatus of the afferent or sensory nerves.

In the human organism the great majority of pain is not excited by peripheral irritation or by traumatic irritation of afferent nerves, affecting their end apparatus, but the majority of pain is produced by reflex contraction and impingement of the nerves where they pass from the spinal column through the intervertebral foramina. We can readily see how this may be true, when we consider the mechanical properties of nerve fiber.

Nerve fiber is tough, tenacious, unelastic,—more so than any other tissue of the body except osseous tissue. No place in the course of nerves, either afferent or efferent, are they surrounded by movable bone, except where they make their exit from the neural canal between the pedicles of adjacent vertebræ.

Contraction of muscular tissue anywhere else in the body will have little or no effect upon the nerves, for the reason that they are more resistant than muscular tissue,

and therefore the nerves will take care of themselves, except in the end apparatus of the afferent nerves. In this case swellings and cell proliferation may become a local excitant of pain due to mechanical injury to the delicate sensitive end apparatus of the afferent nerves.

A contraction, or contractured condition of the musculature of the spine that approximates vertebræ and narrows the intervertebral foramina between their pedicles, will bring osseous tissue to press upon and impinge the nerve sheath and for this reason pain may be, and is, produced in most cases by nerve impingement between pedicles of vertebræ.

The proof of this fact is, that in almost all cases of pain we may give almost instant relief by a specific thrust to overcome the contractured conditions of the musculature of the spine, and especially those tissues, as muscles, tendons or ligaments, which are directly responsible for the approximation of the vertebræ and impingement of the nerve supplying the painful zone.

In cases in which the pain is chronic and unyielding to ordinary treatments, in the head regions, we have, by giving a thrust and relieving the cervical nerves that join the cranial nerves by means of communicating branches, been enabled to relieve the pain as in toothache, tic douloureux, etc.

The pain of appendicitis, intercostal pains, gastralgia, pleurisy, and other pains in the internal viscera, yield very quickly to thrusts that are given for the purpose of relieving the spinal impingement affecting the nerve supply to the painful organ.

III. Where Produced.—In the above remarks we have practically covered the ground as to where pain is produced, and a great majority of all pain is produced by spinal lesions, as indicated above, while the exciting factor of the pain acts in all cases almost wholly upon the peripheral apparatus of the afferent nerve.

In the case of a finger burn, the pain, except that which is instantaneously produced by the injury to the peripheral apparatus of the afferent nerves, is produced at the spinal exit of the nerve supply to the burned finger. While the finger is burned, the afferent excitation travels via the sensory nerve to the spinal center. It is then transferred, and travels over the entire route of the motor nerve.

The first branch of the motor nerve that becomes excited and produces action by means of the end organs in the tissues supplied, is the primary posterior division of the nerve. This nerve is distributed to and causes a contraction of the musculature of the spine. The spine then is contracted before the centrifugal impulse passing over the efferent nerve reaches the finger that is burned, and no doubt the pain, more especially that which continues after the burn, is due to the spinal contraction and consequent nerve impingement.

Where Referred.—Pain is referred in all cases to the peripheral end of the afferent nerve, notwithstanding the fact that it may be produced at the spinal exit of the nerves. This fact of the pain being referred to the afferent nerve ends is, in most cases, as it should be. This fact always enables a person to know the point of irritation, and this assists us in our protective measures against injury.

One noted exception to this rule is in the case of reflex pain. Reflex pain produces many rather complicated phenomena.

There are some phenomena of referred pain that demonstrate the truthfulness of the statement that pain is referred to the peripheral portion of the afferent nerve endings.

A person who has lost a limb will complain of cold feet; a person who has no hands will complain of his fingers getting cold. In this case we evidently have the

pain referred to the location of the former or original endings of the afferent nerves. Now, as nerves are prepared for the reception of an impulse at their peripheral endings, it would seem that the cut end of afferent nerves would not receive sensation. Perhaps, though, as time goes by, the nerves will form new peripheral end apparatus, and in this way sensations are received, but the brain continues to refer them back to the point of the original peripheral endings of the afferent nerve.

Where It Exists.—Pain exists in the brain.

As a further definition of pain, we repeat partly the definition given above. Pain is an interpretation in the brain of an injury to a nerve. The interpretation of pain is made in the brain; consequently pain exists only in the brain. This may not seem plausible to the reader at first.

If the sensory nerves that lead from the cut, burn, wound, injury, or irritation of any kind, are paralyzed, so they cannot be excited, or if they are so impinged that they cannot transmit the impulse, you will feel no pain.

If anything interferes with the conductivity of the nerve or its excitability, the sensation of pain will be decreased thereby in proportion to the amount of interference with the conductivity or excitability.

On the other hand, if a nerve is irritable, excitable or tender, the impulse excited will be excessive and the pain increased in proportion to the increase of excitability of the nerve.

In anæsthesia the conductivity of nerves is destroyed. The excitability is also destroyed, consequently the sensibility, and the patient will feel no pain when under complete anæsthesia.

If a limb is paralyzed, you cannot feel pain, although traumatic injury is done to the limb. This is because there is no excitability of the afferent nerves and no

conduction of the centripetal impulse to the brain. For this reason no interpretation is made and no pain exists. If the nerve supplying any zone in the body is severed, that zone has no sensation, and injury to that part excites no pain. If the nerve supply to the fingers is cut off, the fingers may be amputated without pain. If the spinal centers are benumbed by an injection into the spinal column, operations in the region supplied by the nerves from the segments, so anæsthetized, will excite no pain.

Pain is an interpretation by the brain of an irritation or an injury to an afferent nerve ending; hence it is unavoidable that pain exists truly and only in the brain. If the mind is intensely engaged, a person may feel no pain from a cut or injury. The attention of the brain must be drawn to the excitation; otherwise no interpretation is made and no pain exists. In a fight a person may be wounded without any knowledge or sensation of it.

On the other hand, a patient who expects and is dreading to feel a pain, as they do when they go to a dentist, the pain will be greatly increased by the anticipation which causes an instant reception and interpretation of the afferent impulse.

The peripheral end apparati of afferent nerves are especially prepared for the reception of impulses from irritation, consequently more pain is felt from lesions to the periphery of the body than is felt by traumatic incision of the deeper tissues. Surgeons will elicit more pain by making superficial incisions of the skin than they will when they sever the deeper tissues, which is due to the greater abundance of the afferent nerve endings in the peripheral tissues. As a summary, then, we enumerate the following:

1. Pain is the cry of an injured nerve.

2. Pain is an interpretation made by the brain of an injury to an afferent nerve.
3. Pain is excited by irritation or injury of the peripheral afferent nerve endings.
4. Pain is produced by the impingement of nerves at their point of exit from the neural canal through the intervertebral foramina.
5. Pain is referred to the point of the original peripheral endings of the afferent nerves that are injured or irritated.
6. Pain being an interpretation of an injury to peripheral afferent nerve endings that are made by the brain, therefore it really exists within the brain.
7. Pain indicates that the nerve is alive and it does not need to be deadened by an anodyne, but should be relieved from the mechanical impingement or irritation that causes the pain.

To deaden a nerve that expresses a pain is like killing a boy who reports to you that your house is on fire.

CHAPTER XI.

ETIOLOGY—Continued.

FEVER.

THE etiological factor in the production of fever is worthy of some consideration, and a knowledge of this subject is often helpful in diagnosis. In the works we have read we have not seen advanced any information on the subject of fever that gave a correct statement as to the cause of its production.

Fever is rather a symptom of a disease than a disease. Its chief characteristic is that of an elevation of the temperature accompanied by certain other symptoms, such as acceleration of the pulse, and quickened respiration.

The temperature is maintained uniformly at about 98.6 degrees in the human organism. At all times we have the process of heat elimination and heat production, going on within the body. When the relative rate of heat loss and heat production remains normal, we have the maintenance of the normal temperature. If there is any lack of this equilibrium between heat loss and heat production, we will have an alteration of the temperature from the normal.

In fever we have a derangement of the normal relation between heat production and heat elimination. The nature of the derangement is that heat production is increased, while the heat loss is not increased, or not increased to as great an extent relatively as the heat production is increased.

Heat production is due to an excitation of the nervous system, especially that function of the nervous phenomena that controls the production of heat. The thermo-

genetic centers in the brain are excited and overactive and responsible for the increase in heat production.

In order to have the excitation and impulse produced which excites heat generation, we must have some nerve stimulus present and acting upon either the nerve centers directly through the circulation or reflexly through excitation of the peripheral endings of sensory nerves. Fever is a very common ailment, and for that reason the cause thereof is worthy of our attention.

Cause of Fever.—From a very careful study of the etiological factor causing fever and of the phenomenon thereof, the author has arrived at the conclusion that the increased heat production causing a rise of temperature is due to an overexcitability and undue stimulation of the nerves or thermogenetic centers which is caused by the action of toxins upon the nervous system. In short, fever is the result of toxemia.

Sources of Toxins.—Toxins affecting an excitation of the nervous system, especially of the thermogenetic centers and the action thereof, are as follows:

1. Toxic retention.
2. Bacterial toxins.
3. Autointoxication.

The fact that toxins which are retained in the body, through failure of elimination, will produce a sudden and abrupt rise of temperature, is evident for several reasons:

By toxic retention we refer especially to the retention caused by a failure of skin action or skin elimination. If the skin is varnished, we have a sudden rise of temperature, and fatal results following very quickly. The retention of the elimination which should go on through the skin will accumulate in a very short time in sufficient quantities to have a decided effect upon the thermogenetic centers and cause elevation of temperature.

In case of sunstroke, the skin will cease to act. As a

result, there is a retention of what is normally eliminated by the skin, and at once the toxic retention acts upon the nervous system, causing an abrupt and sudden rise of the temperature. Now this will not happen as long as perspiration is free, because then we have an elimination of the toxic elements which would cause an elevation of temperature. The skin action ceases to act before the temperature jumps up, as in the case of sunstroke.

Active muscular activity produces heat, and evidently does so because of the toxic by-products generated as the result of the muscular activity.

Fever is also incurred by absorption from the alimentary tract, especially in the case of an infection and as the result of the by-products of germ activity. If a child eats food that sours on the stomach and in the bowels, that child may have fever from it, and the severity of the fever will depend upon the amount of germ action and quantity of toxins formed by them.

Germs are always present in the alimentary tract. The toxins, which are the by-products of germ development, are the most potent of all toxins from without which will effect a sudden rise of temperature. There is considerable variation in the amount of the stimulating effect upon the thermogenetic center by the toxins produced by the different varieties of infections.

Since the by-products of some germs are much more toxic than the by-products of others, and the constitutional effects are much more severe from the toxins from one species of germs than from another, we have much more fatal results from one contagious disease than from another.

In all infections and contagions, we can account for the fever readily on the ground of toxins of bacterial origin.

In all cases of contagious fevers we find, first, there must be an exposure and an inoculation of the patient

by some infection; second, there must be a latent period called the incubation period, during which time we have the development of the bacteria within the human organism, and consequently the bacterial by-products of their development. We have no fever until time for the production and absorption of these toxins.

We cannot conceive of any fever that we cannot account for on the ground of toxemia.

If a limb is paralyzed, and if we remove interference with the nerve supply, and re-establish the normal processes of metabolism and circulation in that limb, we will witness an increase of heat production immediately. A limb that has become cold, will become feverish. The temperature will rise above the normal. This seems to be due to the fact that there has not been an elimination of the toxic elements of that limb which have accumulated during the existence of the paralysis.

When the circulation and metabolic processes are re-established, the toxic elements that have been retained in the limb are thrown into the circulation as a result of relieving interference with nerve supply to the lower extremities and re-establishing circulation and absorption. We have had a temperature of from one and a half to two degrees above normal ensue and last for an hour or two following treatment, but here again we know that it is the toxins that are retained in that limb that was paralyzed before treatment, thrown into the general circulation after treatment, which become the exciting cause of stimulation and excessive action of the thermogenetic centers, and the consequent elevation of temperature.

In the case of typhoid fever we first have an infection of the alimentary tract, possibly two weeks before the invasion of fever. We have then what is known as the incubation stage, during which time we have the development of the bacteria, and by the end of that time we have

a sufficient production of toxins which act upon the nerve centers, after their absorption, to produce fever. Toxins, then, are the result of the pathological process of germ development. We have germ development in pyors patches, with a continuation of the production of toxins and a consequent continuation of the fever.

It is well to remember that the germs of themselves do not cause fever, but it is the by-products of their development that excite nerve action and thus cause the fever.

We find that by exciting or stimulating the direct nerve supply to the small intestines, we can establish normal autoprotection and we can in this way stop the pathological processes of typhoid fever, and when we do so, we have stopped the process of the formation of toxins which feed the fever; hence the result of our treatment breaks the course of typhoid fever.

On the other hand, we are also enabled to stimulate the action of the skin, and thus eliminate toxic elements from the circulation. By stopping the production of toxins, and by increasing the elimination of those already produced, we find our patient is soon rid of typhoid fever. This may be done in most cases by producing a condition of nerve supply and vital activity in the bowel sufficient to stop the pathological processes of the fever.

I will quote below my experience with a couple of cases of typhoid fever to show the effects of the development of normal nerve supply, and sufficient vital resistance to stop the bacterial action in the region affected by this fever:

I was called one morning to see a patient who had been confined to his bed with typhoid fever for two weeks. I got a good adjustment, a good stimulation of the nerve supply to the local zone of infection by relieving the contraction of the musculature of the spine of that region from whence came the nerve supply that

supplied the regions affected by the typhoid. The fever dropped from 103 to 101 in about ten to fifteen minutes. I did not remain long in the room, and when I got to my office the wife of the man called me up over the telephone and said: "What shall I do with my husband, he is just sweating so that the whole bed is wet?" I replied, "Let him sweat." Before noon she called the second time, and said, "What shall I do? He is just sweating streams of perspiration." Again I 'phoned, "Don't stop the sweat; if you do, his fever will come back again." By this time his fever had gone entirely and his temperature was slightly subnormal.

In the afternoon he did not stop perspiring. They sponged him with cold water and chilled him through. As a result of that, in about fifteen minutes he had a little fever. As soon as the reaction was perfect, he broke into the perspiration again. The poor woman was so distressed that she called the former doctor. After this the writer refused to visit the patient any more. But the man, in spite of the cold sponging that caused a slight return of the fever, had no more fever of any consequence. He got well quickly and one adjustment accomplished the work of stopping the fever.

We cannot always get the free perspiration after an adjustment. Have had cases in which it was hard to get any skin action for two or three days. We may work two or three days sometimes to break up an attack of typhoid fever.

We remember one time of being called to see a boy about fourteen who was suffering with typhoid fever, the walking variety, of two weeks' standing. He began to have hemorrhages from the bowels. When hemorrhages began they got excited about him and sent for the author. When we saw the case we at once diagnosed it to be a case of typhoid fever, and that was the diagnosis of two other physicians. We gave the boy a good adjustment

about seven o'clock in the evening. He broke out in a profuse perspiration immediately. At the time of examination the patient's temperature was 104 plus and pulse rate 120. The next morning at nine o'clock we found him with a normal temperature and a pulse of 72. We wanted his bowels to remain open, consequently we stimulated the nerves to the bowels to create that condition. He got along nicely three or four days, the bowels moving freely. The boy was sleeping and up walking around and had an uncontrollable appetite.

The mother got alarmed because she thought the bowels were moving too freely, and without my knowledge or consent, she sent to the drug store and got a supply of calomel and gave the boy a heroic dose. As a result of that mercurial purge, the hemorrhage of the bowels was re-established. Those bowels had not had time to heal properly from the ulceration.

When we heard of what had been done we refused to treat the case further. They called in two doctors and they treated his bowels for about ten days before they got him straight, and they said this: "We will have to acknowledge that Dr. Gregory did stop the fever." The patient had no fever after the night of the first adjustment.

We believe we are justified in our conclusion that fever is the result of toxins and they are the result of the action of germs, and that germ action is permitted by lowered vitality or lack of autoprotection. When we establish normal autoprotection, we stop germ growth and development and when we start the skin to action we eliminate the toxins. When the toxic production is stopped and when the toxins are eliminated there is nothing to feed the fever and we can surely get rid of it. Many cannot believe this and many will continue to die by the orthodox route when they could get well by the use of rational methods.

PART III.

NERVE SUPPLY.

CHAPTER I.

NERVE SUPPLY.

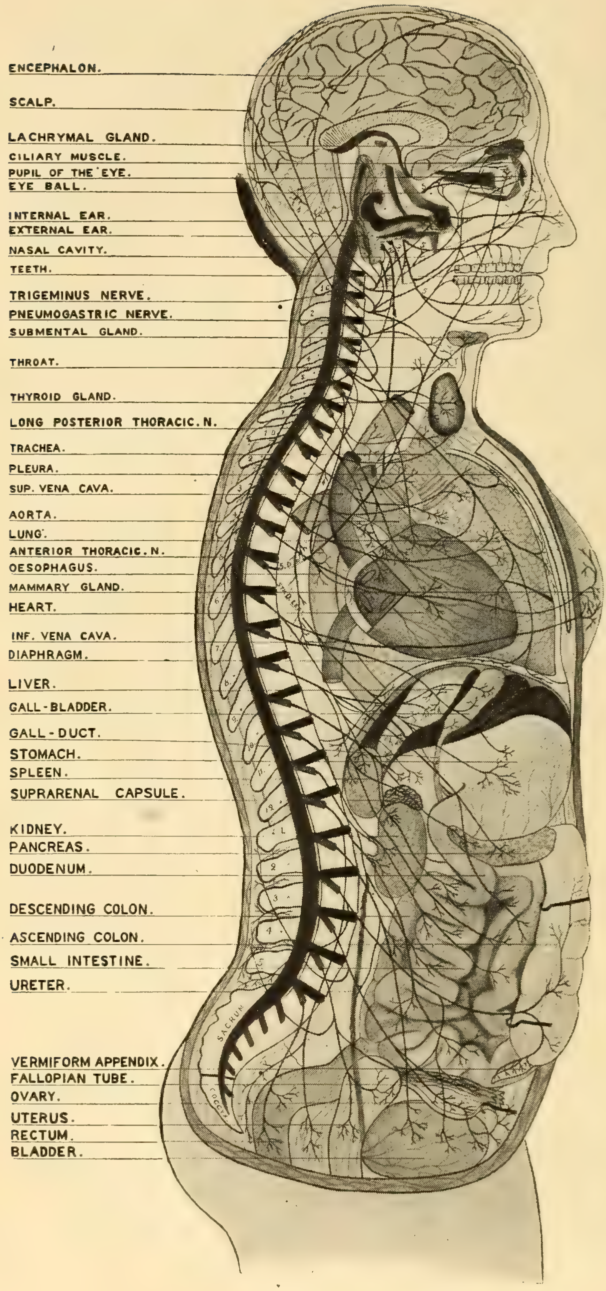
A KNOWLEDGE of the nerve supply to the different organs, viscera, and parts of the body, is necessary from the standpoint of diagnosis and from the standpoint of treatment by practitioners who practice chiropractic spondylotherapy, or any other method of spinal treatment.

The most important feature of this subject from the standpoint of spinal treatment is to understand the connection between the nerves from the different segments of the spine and the organs supplied. We therefore do not study so much the branching and names of the branches of nerves to the different muscles, as we do the connection between the spinal segments and the different viscera and extremities.

For the above reasons we study the nervous system from an entirely different standpoint than the ordinary. In the study of the subject of nerve supply, we see manifest a very important precautionary arrangement in the nerve supply to the different parts and more especially the principal viscera and organs of the body.

This arrangement consists of nerves from different segments of the spine supplying, or helping to supply, directly or indirectly, the different viscera and parts of the body. This arrangement affords the best possible protection in the case of interference with any one nerve to any organ or part for the reason that the other sources of nerve supply would not likely be interfered with at the same time.

SCHEME OF THE ORIGIN AND DISTRIBUTION OF THE SPINAL NERVES, SHOWING THE SPINAL NERVE SUPPLY OF THE DIFFERENT VISCERA AND ORGANS OF THE HUMAN BODY.



5-6-7&8 CERVICAL TOGETHER WITH THE FIRST DORSAL PAIRS OF SPINAL NERVES FORMS THE BRACHIAL PLEXUS, THEY ALSO SUPPLY THE HANDS, ARMS AND SHOULDERS.

THE TWELFTH THORACIC AND ALL THE LUMBAR AND SACRAL PAIRS OF SPINAL NERVES FORMS THE LUMBO-SACRAL PLEXUS, THEY ALSO SUPPLY THE FEET, LEGS AND HIPS.

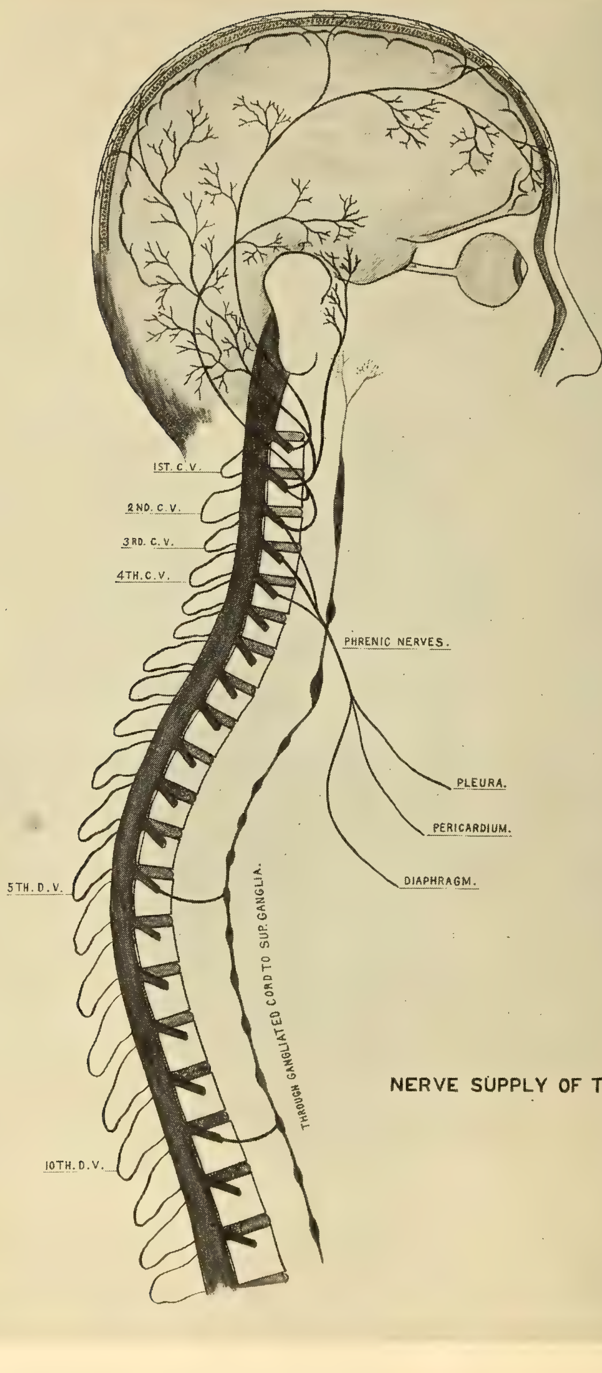
If one portion of the nerve supply to any organ is interfered with, then the remaining nerves that partly supply this organ will maintain their vitality and function in a measure.

Each organ possesses a direct nerve supply from the spine, which supply will have the most influence upon that organ, and in case of lesions affecting the principal nerve supply, the derangement of the function of the organ is more marked, whereas, if the nerves that are less important, as to the amount of supply furnished, are interfered with, then the derangement or malfunction of the organ will be less correspondingly.

In case of irritative lesions of the peripheral afferent nerve endings in any organ or part of the body, then the impulse excited thereby is transmitted to the spinal cord by way of the most abundant and most direct afferent nerve supply; consequently the reflex lesions of the spine are most marked at that segment of the spine giving off the greatest proportion of the nerve supply to the organ affected.

In our study of the nerve supply in this connection, we will consider the nerve supply to the principal organs and parts of the body individually by enumerating their direct and indirect nerve ramification, and consequently the direct and indirect points of spinal lesions where these organs may be affected, as they pass from the spinal column and from the brain.

In studying the nerve supply to the viscera of the trunk, we find according to our anatomical text-books that the apparent supply only is given, and usually the nerve supply is given by stating that it is from one of the ganglia of the sympathetic system that is situated in the relative portion of the trunk, and sometimes the nerve is given and appears microscopically to be from a terminal ganglia of the sympathetic that is given off from one of the great ganglia, as the cardiac, solar, or pelvic plexus.



NERVE SUPPLY OF THE SCALP.

We find it necessary, then, to trace the branches that join both the great ganglia and terminal ganglia back to their spinal or cranial origin, that we may be able to comprehend the regions of the spine where we may affect an organ, or which spinal nerves supply the function to the organs, and at what points spinal lesions may interfere with nerves that affect an organ through the ganglia that directly supply it.

We also give some attention to the spinal and cranial nerves, and more especially to spinal nerves that join the terminal ganglia of the sympathetic, which supply the different viscera, and which terminal ganglia are situated in approximate relation to the organs supplied. In some cases the cells of the terminal ganglia are situated within the walls of the viscera that they supply.

Nerve Supply to the Scalp.—We will enumerate the different spinal nerves that supply terminal fibers to some portions of the scalp, some to greater and some to lesser portions:

1. Suboccipital.
2. Great auricular.
3. Posterior auricular.
4. The occipital third.
5. The occipital minor.
6. The occipital magnus.
7. Fourth cervical per circulation.

1. The suboccipital nerves are given off and constitute the first pair of nerves of the spinal cord, and pass out from the neural canal through the post condyloid notches on either side between the posterior arches of the atlas and the occipital bone. The suboccipital nerves give off branches of distribution which pass upward and ramify the scalp, and thence pass forward to and supply the forehead, and thence continue downward to the eyebrows. This pair of nerves give the most direct and the most extensive nerve supply to the scalp.

2. The great auricular nerves, whose fibers of origin are traced to the second and third pair of cervical nerves, ramify regions of the scalp around and adjacent to the ears on either side.

3. The posterior auricular pair of nerves which are given off from the second pair of cervical nerves, helps to supply portions of the scalp posterior to the ears.

4 and 5. The occipital minor and occipital third pair of nerves affect small portions of the scalp by direct ramification.

6. The occipital magnus nerves pass to and supply the lateral sides of the scalp, anterior to the beginning and ascending portions of the occipital nerves.

7. The fourth cervical pair of nerves have an indirect effect upon the scalp. This is because of their influence upon the circulation. They form principally the phrenic nerve, and influence the lungs and diaphragm, and are responsible for their expansion; hence the middle cervical nerves by affecting the circulation of the thoracic cavity, have a compensatory influence upon the circulation of the brain. Any failure of the expansion of the lungs and of the diaphragm may cause a congested and a throbbing in the brain, because of the excess of blood in the brain; whereas, on the other hand, a free expansion of the lungs and of the tissues around them, as the pleura and diaphragm, will prevent the congestion of the brain.

The circulation of the brain is intimately associated with the vascular supply to the scalp, by means of capillary connections between the blood vessels which pass between the bones of the scalp, through the sutures of the articulations.

We have also an indirect effect upon the scalp from the different segments of the spine, down to and including the tenth segment. This is because of the action of these nerves upon the glands of the skin. All the nerves, down to and including the tenth, have an effect upon

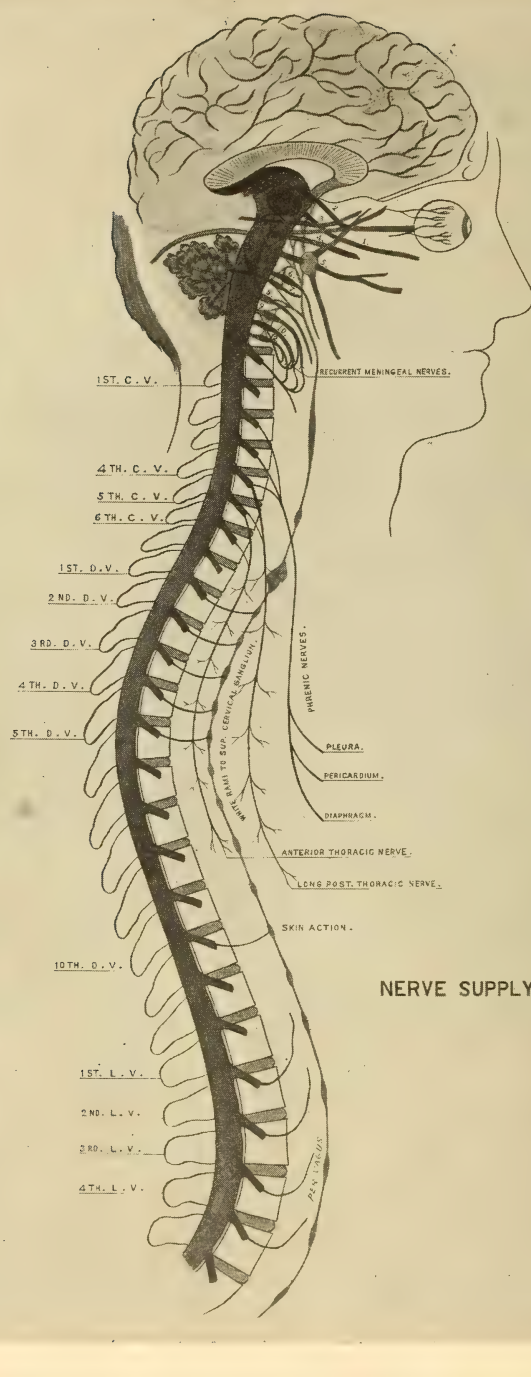
the skin of the body from that segment from which they arise upward. The tenth, however, has an effect upon the integument of the body, both below and above; consequently is the central place for skin action of the entire body.

Alopecia is one of the most frequent results of a failure of the nerve supply to the scalp. In the treatment of this trouble it is well to consider other factors than the nerve supply. As a rule, the muscular tissues of the scalp are wasted or partly absorbed, due to an interference with the trophic nerve supply to the scalp. Massage and vibratory treatment of the scalp will stimulate and re-establish the formation of the muscular tissues, and also increase the vascularity of the scalp, both of which conditions are necessary to the development of the hair.

A development of muscular tissues and restoration of the normal nerve supply will induce a healthful condition of the scalp, which is necessary to overcome alopecia. From the experience we have had, we are sure that a great majority of the cases of alopecia may be relieved. Under the influence of the normal nerve supply and increased vascularity and muscular development of the tissues of the scalp, the hair may be caused to grow again on a head that has long been bald.

Nerve Supply to the Brain.—The brain is the greatest accumulation of nerve matter in the body, and is the most important of any nerve matter of the entire system. The brain itself being composed of nerve matter, we would not at first think of a nerve supply to the brain, but we find that nerves ramify the brain substance and the meninges of the brain.

The circulation of the brain and the metabolic processes thereof, and also the functioning of the brain, is dependent upon the nerve supply to it. We will enumerate the principal nerves that supply and affect the brain, under the following headings:



NERVE SUPPLY OF THE BRAIN.

1. Lumbar connections.
2. Suboccipital nerves.
3. Upper thoracic nerves.
4. Lower thoracic nerves.
5. Lower cervical nerves.
6. Fourth cervical nerves.
7. Irritation of any nerve.

The suboccipital nerves affect the meninges of the brain through their branches given to the formation of the recurrent meningeal nerves. The fourth cervical nerves affect the brain by influencing the compensatory circulation between the cranial and thoracic cavities.

The lower cervical nerves have an indirect action upon the brain, or rather upon the circulation of the brain, because of their supply and effect upon the muscles of respiration. In this way the expansion of the chest or thoracic cavity is affected, and the expansion of the thoracic cavity indirectly affects the circulation of the brain.

The upper thoracic nerves affect the brain, its metabolism, and functional activity because of their connection by way of the white rami communicantes which join the sympathetic gangliated cords and pass with the superior rami stream to the superior cervical ganglia. From this point impulses are carried by way of the gray rami on to the cranial nerves, which rami after joining the cranial nerves, follow them in both directions, back to their origin in the brain substances, and also throughout their peripheral ramifications.

The lower thoracic nerves have a very indirect yet positive action upon the brain. They have an influence upon the circulation of the brain because of phrenic anastomoses. The lower thoracic nerves from the ninth to the twelfth, communicate with the terminal branches of the phrenic nerve, which has such a decided influence

upon the circulation of the thoracic cavity and consequently upon the circulation of the brain indirectly.

The lumbar connections have an important and positive influence upon the condition of the mind and brain. This connection is undoubtedly through the communication of the lumbar nerves with the terminal branches of the pneumogastric in the hypogastric or pelvic plexus. The evidence of this is more marked in functional manifestations observed in clinical experience than in anatomical tracings.

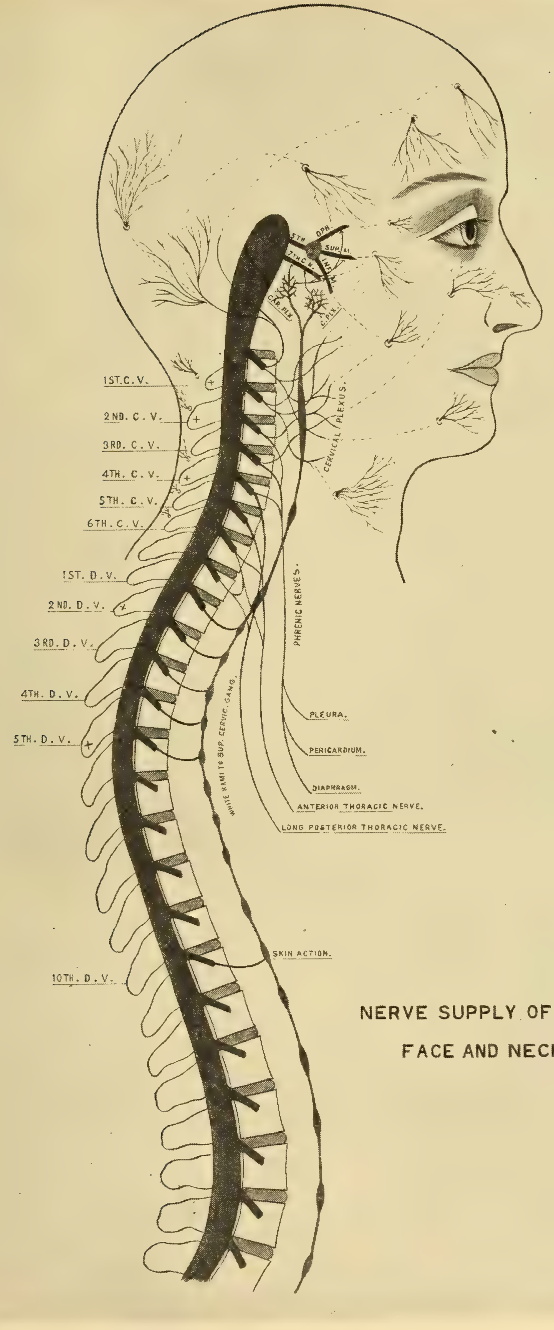
Irritation of Any Nerve.—The irritation of any nerve causes waste of nerve energy. Any waste of nerve energy depletes the general store. It is a well-known fact that persons suffering with toothache or intense pain in any part of the body, have not the normal equilibrium of mental action, cannot think as they would normally, and for this reason we consider nerve waste detrimental to the normal functional activity of the brain.

Nerve Supply to Face and Neck.—The principal portion of the nerve fibers ramifying and supplying the integument of the face and neck, is derived from cranial nerves and from the cervical plexuses. The dorsal nerves also affect the circulation of the skin of the face and upper parts. The nerves supplying the face and neck may be enumerated as follows:

I. Facial nerves.
II. Trigeminal nerves.
III. Upper four cervical nerves.
IV. Upper five thoracic nerves.
V. Tenth pair of thoracic nerves.

I. The Facial Nerves are the seventh pair of cranial nerves and help in the supply of the entire surface of the face supplying both the skin and facial muscles.

II. The Trigeminal Nerves.—This pair of nerves is the fifth pair of cranial nerves and they help supply the skin of the face, and also the deeper tissues through



NERVE SUPPLY OF THE FACE AND NECK.

the ophthalmic, superior maxillary and inferior maxillary branches.

III. Upper Cervical Nerves.—The upper four pairs of cervical nerves give off the branches forming the cervical plexus which are distributed to the muscles and skin of the neck and face. The upper cervical nerves become involved in cases of barber's itch and other eruptions and diseases of the face.

IV. Upper Thoracic Nerves.—The upper five or six pairs of nerves of the upper thoracic region furnish the white rami communicantes which form the upward stream which joins the gangliated cords of the sympathetic and sends fibers by way of the superior cervical ganglia, and in this way affect the glands of the skin of the face and neck. These nerves affect the action of both the sebaceous and sweat glands.

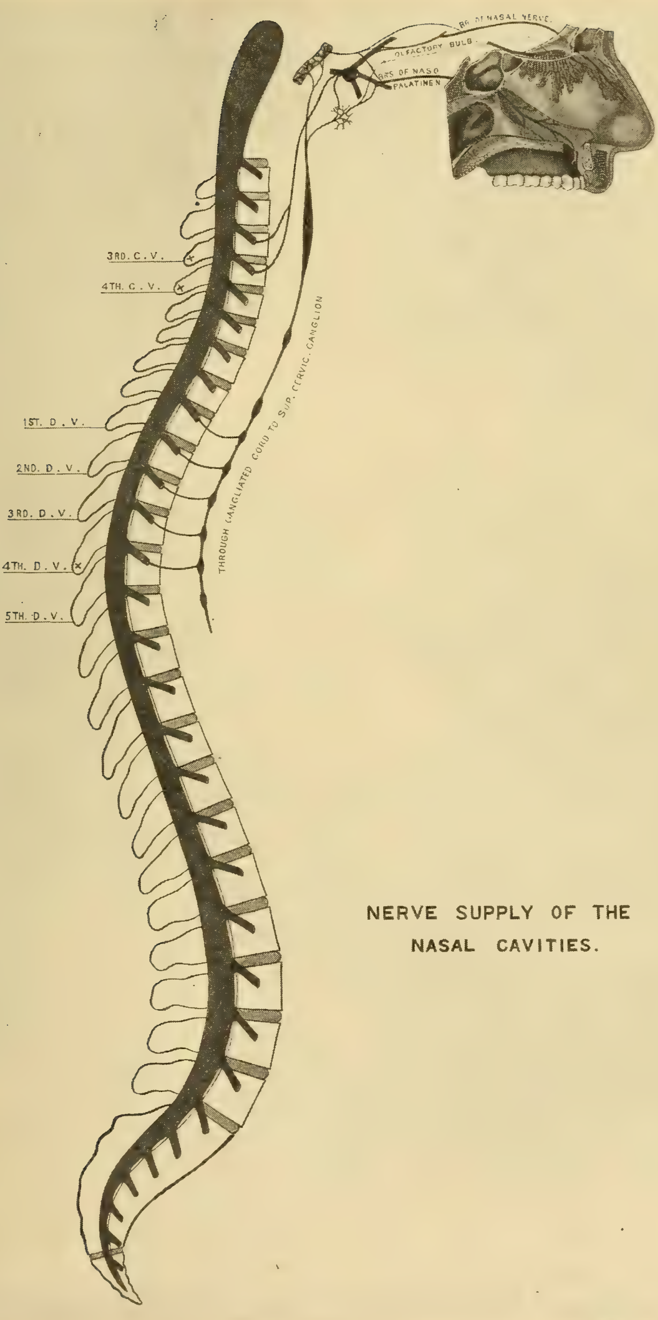
V. Tenth Thoracic Nerves.—The tenth pair of thoracic nerves, because of their influence upon skin action and elimination, affect skin conditions. Their action is general and produces decided influence upon the skin action of the neck and face.

The tenth pair of thoracic nerves also, through their influence upon the amount of the elimination of the kidneys, decrease the amount of elimination through the skin.

These nerves also join the terminal branches and have a reflex influence upon the fourth pair of cervical nerves which join in the formation of the cervical plexuses, and in this way they affect directly the organs supplied by the brachial plexus, especially the parts supplied by the fourth pair of cervical nerves.

NERVE SUPPLY TO NASAL CAVITY

The nerve supply to the nasal cavity is especially important to understand and in the treatment of nasal catarrh and other diseases of the



NERVE SUPPLY OF THE
NASAL CAVITIES.

Nasal Cavity
1. Third pair of cervical nerves.
2. Fourth pair of cervical nerves.
3. The fifth pair of thoracic nerves.
4. The tenth pair of thoracic nerves.

The direct supply that mostly affects the nasal cavity is derived from the middle cervical region. The normal condition of the nasal cavity is dependent upon the integrity, principally of the third and fourth cervical pair of nerves, while the indirect supply, affecting the nasal cavity, is from the upper thoracic nerves, more especially from the fourth and fifth thoracic pair of nerves.

The upper thoracic nerves ramify and supply the nasal cavities by way of the white rami communicantes to the superior cervical ganglia, and thence by way of the gray rami to the terminal ganglionic supply of the nasal cavities.

The Tenth Pair of Thoracic Nerves.—These nerves have the most influence upon general skin action of any pair of nerves.

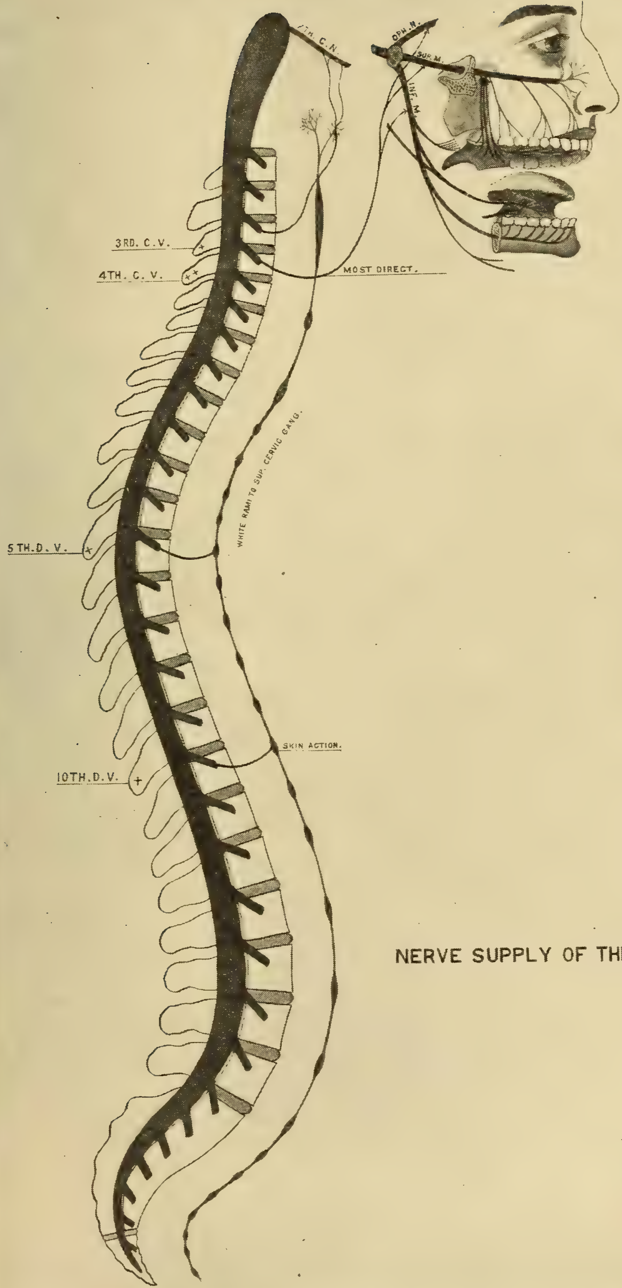
Any interference with this pair of nerves will interfere materially with the general skin action and consequently affect the action of the mucous membranes of all parts of the body, but more especially with the action of the mucous linings of the nasal cavities.

The mucous membranes will in a way make up for the failure of action of the skin as in the case of coryza, in the case of bad colds.

Interference with the tenth pair therefore will affect the action of the mucous membranes, and when we relieve all interference with the tenth pair of nerves we thereby re-establish the general skin action and thus relieve the extra work imposed upon the mucous membranes because of interference with the skin action.

Nerve Supply to the Teeth and Gums:

1. Third pair of cervical nerves.



NERVE SUPPLY OF THE TEETH & GUMS.

2. Fourth pair of cervical nerves.
3. Fifth pair of thoracic nerves.
4. Tenth pair of thoracic nerves.

The fourth pair of cervical nerves seem to ramify very directly, and to have the most decided influence upon the teeth and gums of any pair of nerves. They join the trifacial nerves, and it is perhaps through this route that most of the impulses are carried to the teeth and gums.

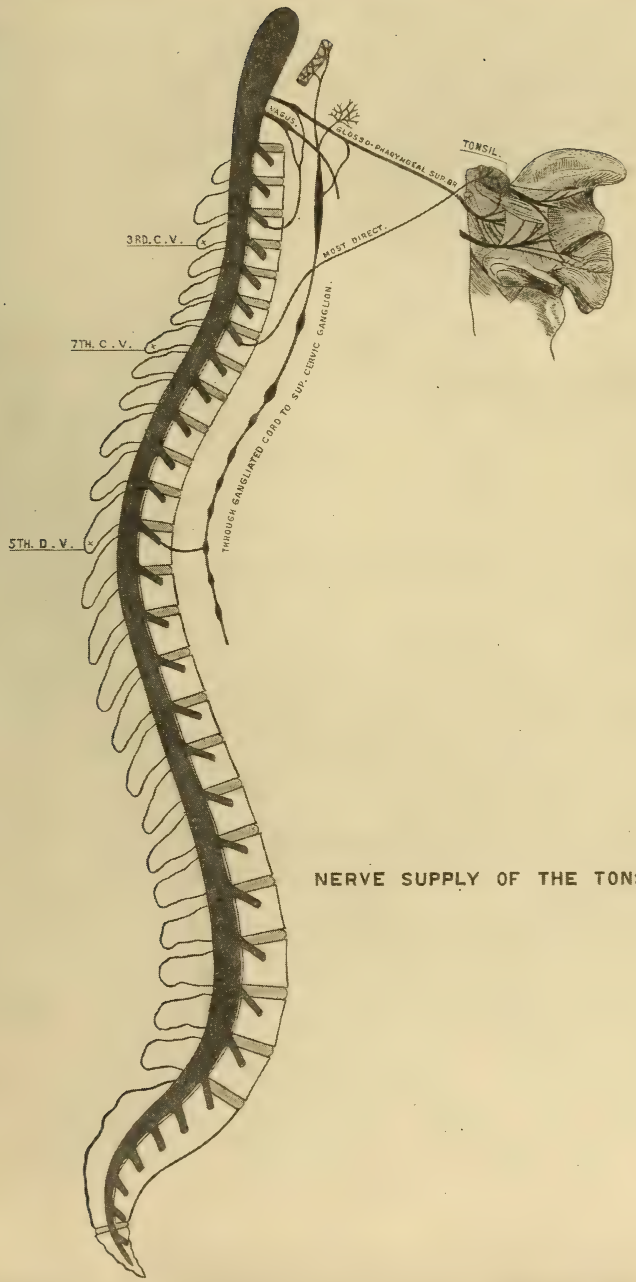
The fifth thoracic nerves affect the teeth and gums, and other organs of the head and throat, through the white rami communicantes connecting with the sympathetic cords, and by way of the superior cervical ganglia, which send branches to the cranial nerves.

The tenth pair of thoracic nerves, it seems, has an influence upon the teeth and gums. The tenth pair of thoracic nerves affect the kidneys, and we have associated with kidney trouble certain conditions of the gums that are evidence of disease of the kidneys because of this almost uniform association of these troubles. The tenth pair of thoracic nerves is central place for skin action. It is possible that through the influence upon the skin that we have the teeth and gums affected, also, as they belong more especially to this portion of the anatomic or histological structures.

Nerve Supply to the Tonsils.—We enumerate below the nerves that directly and indirectly affect these organs:

1. Glosso-pharyngeal.
2. Pneumogastric nerves.
3. Fifth thoracic nerves.
4. Middle cervical nerves.
5. Seventh cervical nerves.
6. The first cervical nerves.
7. The second cervical nerves.

The nerve supply to the tonsils seems to be most



NERVE SUPPLY OF THE TONSILS.

direct from the fifth and sixth cervical nerves. The seventh cervical, however, seems to have a direct action in many cases upon the tonsil. Certain experiences we have had in making adjustment of the seventh cervical, prove conclusively that there is an influence, directly or indirectly, that has a decided effect upon the condition of the tonsil.

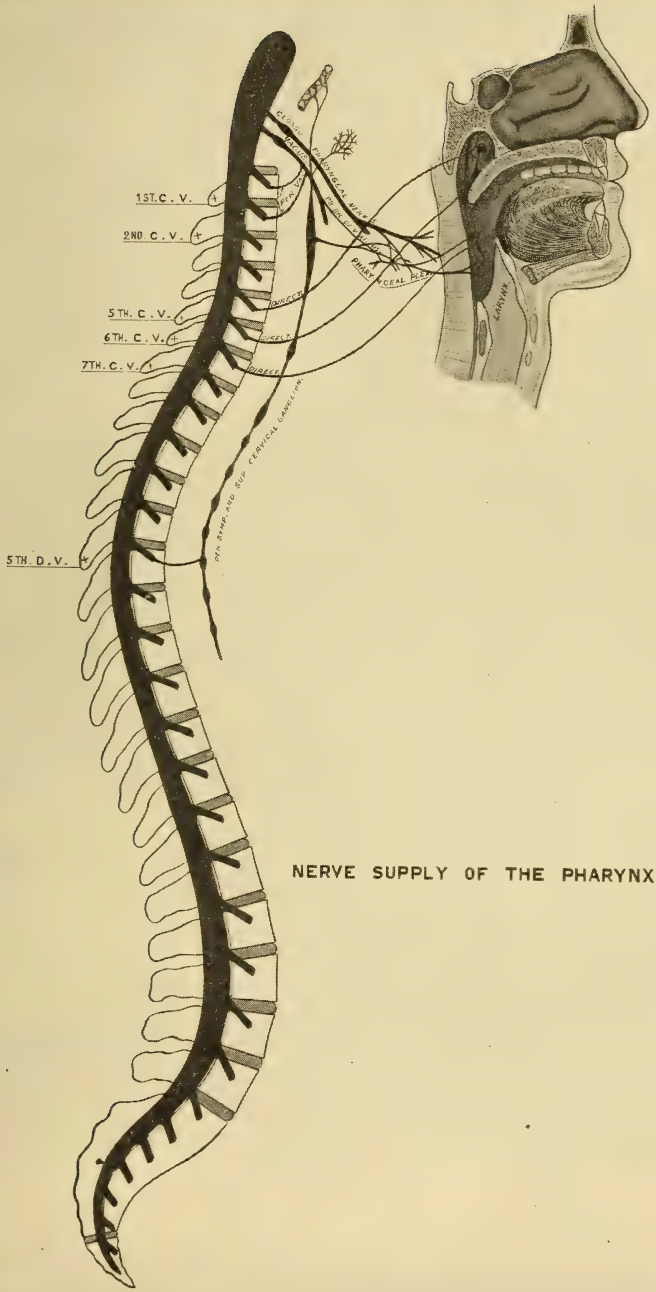
The pneumogastric nerve affects the tonsil by giving off a branch thereto, but we do not affect the pneumogastric by spinal treatment, as it is a cranial nerve, except through the connections with the pneumogastric from the first and second cervical nerves. For this reason we have an indirect connection between the first and second pair of cervical nerves and the tonsils. And, further, we have a like connection with the glosso-pharyngeal nerves from the first and second cervical pairs of nerves.

From the fifth thoracic pair of nerves we have a connection with the tonsils by way of the upper stream of white rami communicantes and the superior cervical ganglia, and their connection with the pneumogastric, glosso-pharyngeal, and other cranial nerves.

The tonsils receive a decided nerve supply through the sympathetic branches of the glosso-pharyngeal nerves, and from the pharyngeal plexus, which branches form the plexus tonsillaris.

Nerve Supply to the Pharynx.—We enumerate the following nerves that have the most direct action and that indirectly affect the pharynx:

1. First cervical per vagus.
2. Second cervical per vagus.
3. Fifth and seventh cervicals.
4. Upper dorsal per sympathetic.
5. Nerves per pharyngeal plexuses.
6. Nerves per glosso-pharyngeal plexuses.
7. Lower spinal nerves per phrenic and vagus.



NERVE SUPPLY OF THE PHARYNX.

The above enumeration is explanatory of the connections and manner in which the nerves enumerated affect or help to supply the pharynx.

NERVE SUPPLY TO THE THROAT AND LARYNX.—We enumerate the following nerves that directly and indirectly ramify and affect the functions of the throat and larynx:

1. Pneumogastric.
2. First cervical.
3. Second cervical.
4. Fourth cervical.
5. Seventh cervical.
6. The eighth cervical.
7. The fifth thoracic.

The vagus affects the throat and larynx per superior and recurrent meningeal plexuses.

The first pair of cervical nerves affect the throat and larynx through the same channels by giving a branch to the vagus.

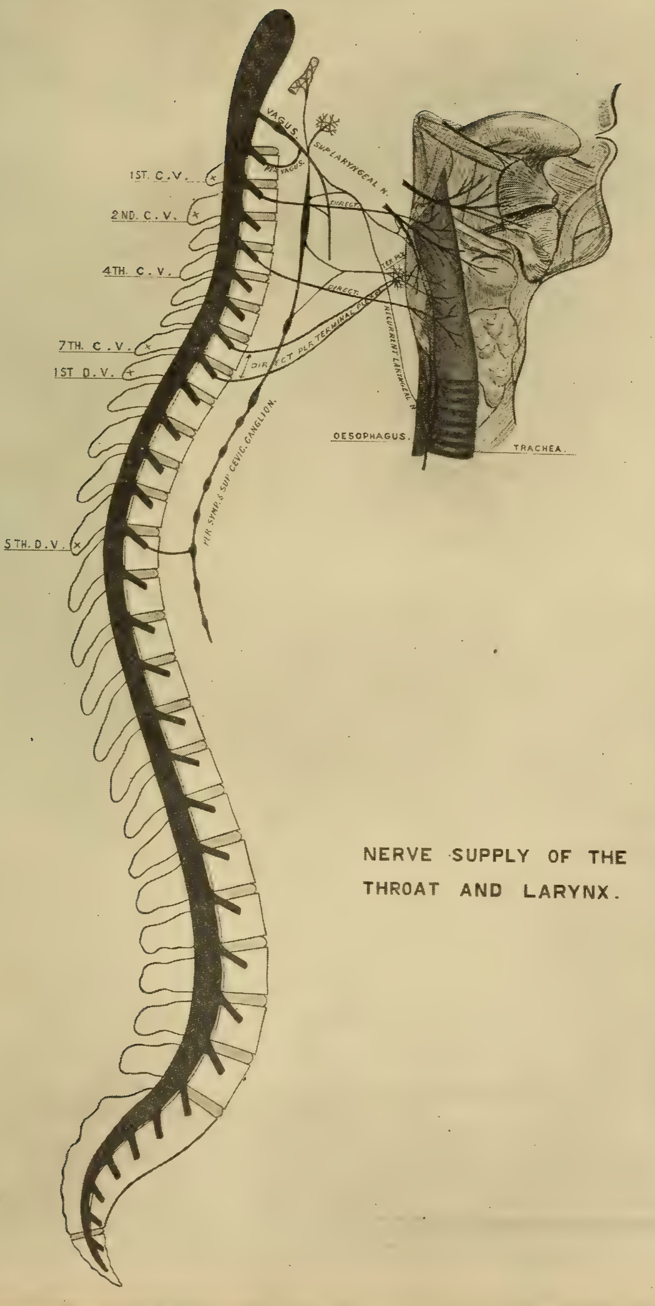
The second pair of cervical nerves ramify directly the larynx and throat or send branches to terminal ganglia which supply these organs.

The fourth pair of cervical nerves also send direct branches to the throat and larynx or to the terminal ganglia supplying them.

The seventh pair of cervical nerves send branches or fibers directly to the terminal plexus of this region. Some cases of sore throat are directly affected by seventh cervical adjustment.

The eighth pair of cervical nerves affect the throat and larynx in the same way as does the seventh pair, and often have a very decided influence upon the functions of these organs.

The fifth thoracic pair of nerves has a most potent influence upon conditions of the throat. The connection existing between the fifth thoracic nerves and throat is by way of the upward stream of white rami communi-



NERVE SUPPLY OF THE THROAT AND LARYNX.

cantes and by way of the superior cervical ganglia of the sympathetic. We have most positive results in cases of sore throat by giving a thrust to the fifth thoracic vertebra for the relief of the fifth thoracic nerves, especially the nerve on the right side.

This fact is of special importance to us in the treatment of not only acute cases of sore throat, but also in the treatment of the tonsils, larynx, pharynx, posterior nares and salivary glands. The fifth pair of thoracic nerves, the one on the right side especially, are involved in cases of diphtheria, scarlet fever, mumps, croup, and other diseases that affect the throat.

NERVE SUPPLY TO THE EYES:

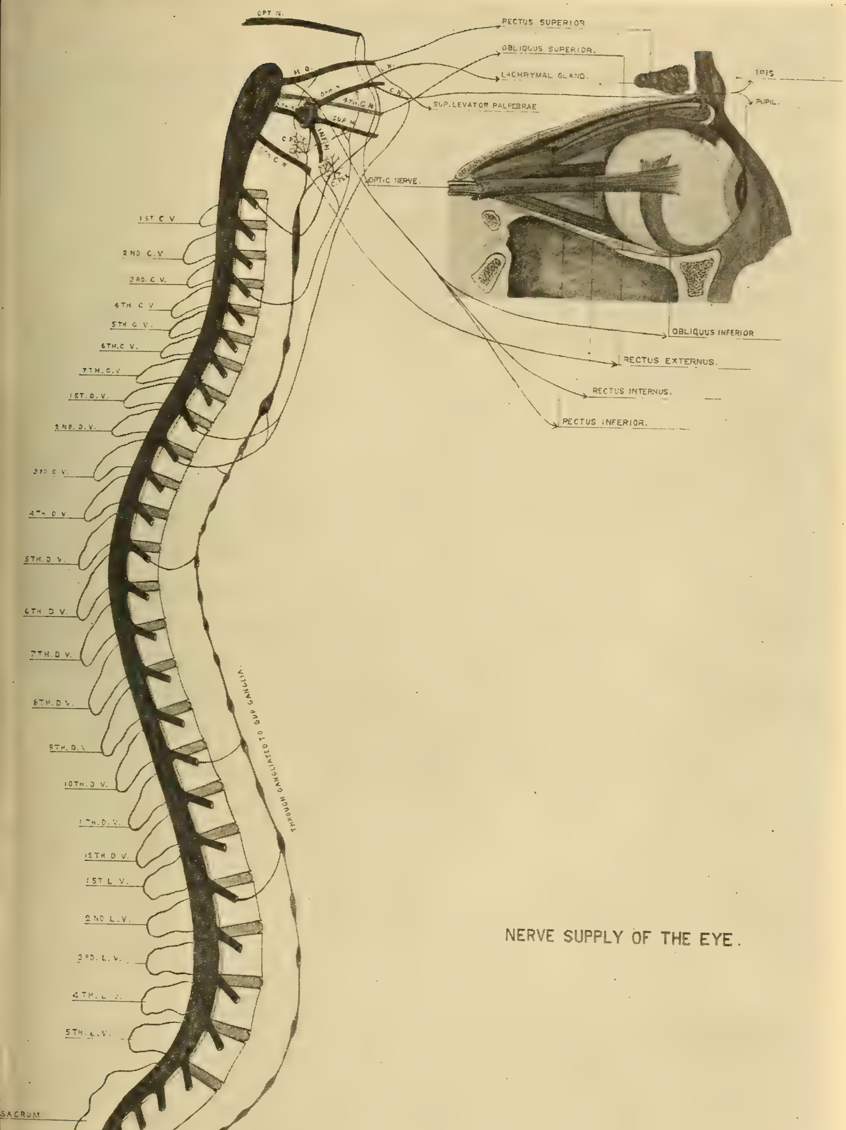
1. Optic nerves.
2. First cervical nerves.
3. Fourth cervical nerves.
4. The upper thoracic nerves.
5. The fifth thoracic nerves.
6. The tenth thoracic nerves.
7. The first two lumbar nerves.

The optic nerves pass directly from the cortical surfaces of the occipital lobes forward to the retina of the eye. The optic nerves, however, do not seem to possess the properties of function of the ordinary nerves. They owe their power of action, and of transmission, entirely to the communicating branches they receive from the spinal nerves.

The first pair of cervical nerves join and help to form the recurrent meningeal nerves, and therefore affect the nourishment of the cortical surfaces of the occipital lobes of the brain.

The fourth pair of cervical nerves have the most direct, most decided, and most positive effect upon the optic nerves affecting their visual power, and especially influencing the power of action of the pupils of the eyes.

We have restored sight by an adjustment of the



NERVE SUPPLY OF THE EYE.

fourth cervical vertebra. This is because of the removal of interference with the fourth pair of cervical nerves.

The first and second pair of thoracic nerves have an influence upon the action of the ciliary muscles of the eye, and for this reason lesions of the upper thoracic region may become factors in the derangement of vision, especially of the power of accommodation.

The fifth thoracic pair of spinal nerves have an action upon the cranial nerves by means of the upward stream of white rami communicantes, and they seem to affect, mostly, the eyeballs. The author has had some cases who complained of pain in the eyeballs; this pain was immediately relieved by removing interference with the fifth pair of thoracic nerves, or by a fifth thoracic adjustment.

The effect of the tenth pair of thoracic nerves upon the eyes, has long been observed in clinical experience. Associated with certain kidney troubles, we have certain visual troubles. Now, the manner in which the tenth pair of thoracic nerves affect the optic nerves is obscure.

The most plausible connection that we can see, and probably the only connection we can figure, is through the communication of the tenth thoracic nerves with the phrenic pair of nerves, the phrenics coming as they do from the fourth cervical, and these nerves control the power of sight of the eyes. We cannot explain this connection by means of the white rami fibers joining the sympathetic, because the tenth pair of thoracic nerves belong to that division of the spinal nerves that join the downward stream of the white rami communicantes.

This fact leaves the only channel of connection that we can trace between the eyes and the tenth thoracic, by way of the afferet fibers of the phrenic nerves which affect reflexly thats negment of the cord giving the fourth pair of cervical nerves, which control the visual apparatus of the eye.

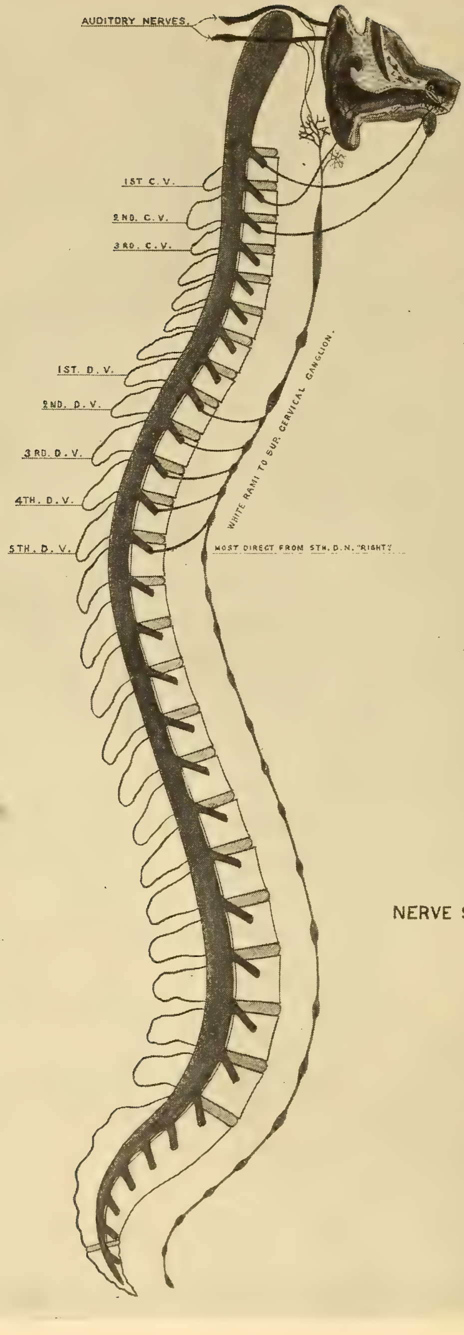
Eye affections have come under our notice in which, when we adjust the tenth thoracic vertebra, we produce certain positive and decided effects immediately in the eyes. Cases in which there is a retention and congested condition in the eyelids and in the orbital regions, we notice immediately after an adjustment an intense exudate and flow of tears from the eyes.

We have had patients wet their handkerchief in a few minutes' time after a tenth thoracic adjustment. Now this phenomenon seems to be due to the effect of the tenth thoracic upon skin action. Again we note that in affections of the eyelids, the tenth thoracic seems to have the most effect upon the eyes, especially the eyelids.

The first lumbar nerves have a reflex connection with the eyes. This is evidenced by the fact that when we find tenderness of those nerves, the patient will involuntarily close the eye when we palpate the tender first lumbar nerve. This is a phenomenon we have often noticed, but can give no explanation except it is because of the connections through the sympathetic system. In some cases we have found that the first lumbar lesions seem to have an influence upon the health and vision of the eye, because of the fact that after an adjustment of the first lumbar vertebra eye troubles will disappear, but we have not adjusted this nerve alone, however, and studied effects, but always in connection with other nerves that affect the eye.

Nerve Supply to the Ear.—The most direct action we have upon the ear is through the upper cervical and upper thoracic nerves. We enumerate the following as furnishing the nerve supply to the organs of hearing:

1. Acoustic nerves.
2. First cervical nerves.
3. Second cervical nerves.
4. The third cervical nerves.
5. The upper thoracic nerves.



NERVE SUPPLY OF THE EAR.

The acoustic nerves seem to depend wholly upon the connecting branches of other nerves for the power of functioning.

The first and second and third pairs of cervical nerves join and affect the terminal ganglia which supply the apparatus of hearing, and also affect the circulation of the brain per the recurrent meningeal nerves, and thus have an influence upon the auditory centers in the brain.

The upper thoracic nerves affect hearing through the upward stream of the white rami communicantes and through the superior cervical gangliated substation which sends gray rami directly and by way of the internal carotid plexus to all of the cranial pairs of nerves.

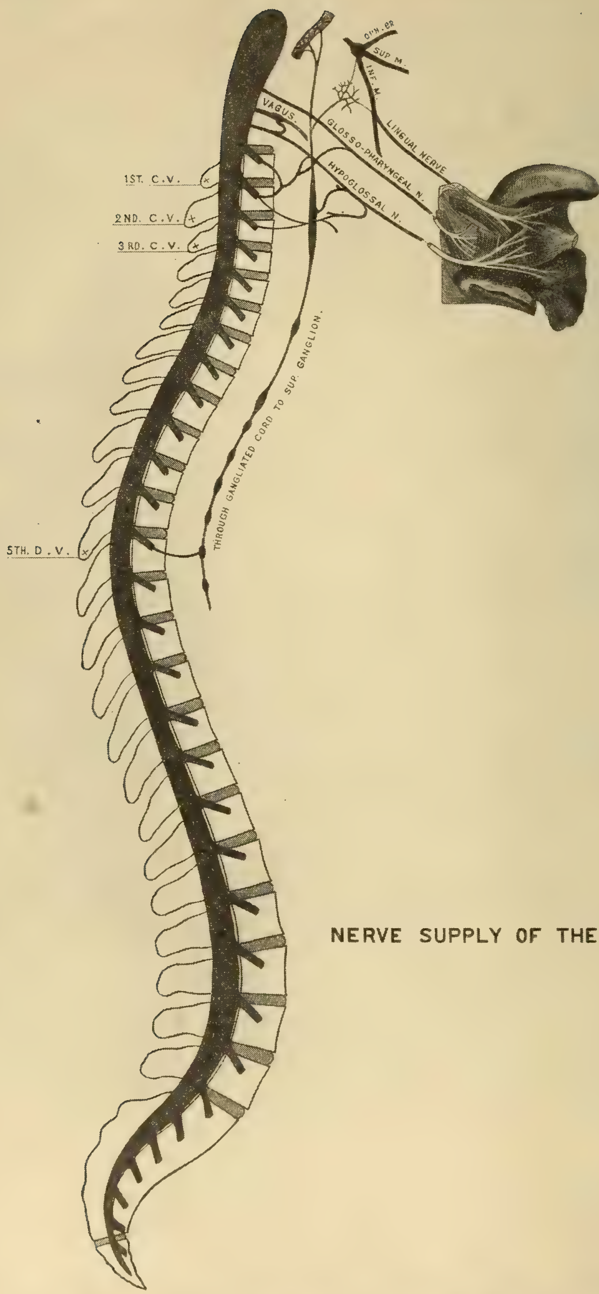
Nerve Supply to the Tongue:

1. Hypoglossal.
2. Glosso-pharyngeal.
3. The upper cervical.
4. The lower cervical.
5. The fifth thoracic.

The first two of the above are of the cranial nerves, which furnish branches of ramification to the tongue.

The upper cervicals, the first and second, have an effect upon the tongue, because of branches given to the glosso-pharyngeal and hypoglossal nerves.

The fifth to seventh cervical nerves may have communicating branches to terminal ganglia of the sympathetic which gives off fibers that join the facial nerve. The fifth thoracic has decided action upon the tongue, and is especially involved in glossitis. The connection existing between the fifth pair of thoracic nerves and the tongue is by way of the upward stream of the white rami communicantes through the superior cervical ganglia, and from thence by way of the gray rami to the terminal ganglia supplying the tongue and the lingual nerves.



NERVE SUPPLY OF THE TONGUE.

Nerve Supply to the Thyroid Glands:

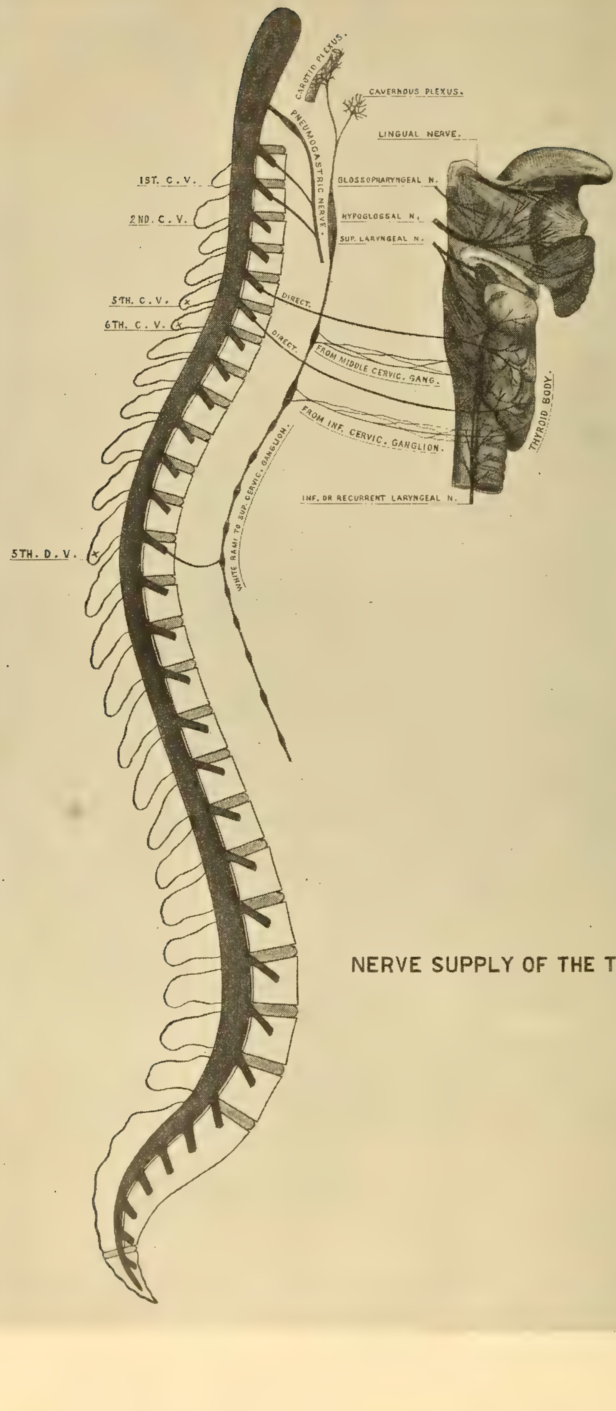
1. Pneumogastric.
2. First cervical.
3. Second cervical.
4. The lower cervical.
5. The fifth thoracic.
6. Middle cervical ganglia.
7. Inferior cervical ganglia.

The first cervical nerves, and also the second cervical pair, join the pneumogastric, and therefore have an influence upon the pneumogastric fibers which join the pharyngeal plexus, and supply the thyroid gland.

The lower cervical nerves directly ramify the thyroid gland, and are responsible for its condition to a considerable extent.

The middle and inferior cervical ganglia both send branches into the thyroid glands. The thyroid glands also receive a nerve supply from the inferior laryngeal nerves, and possibly also from the superior laryngeal nerves, both of which are partly made up of branches of the pneumogastric.

The pneumogastric nerves help to supply the thyroid glands principally through the inferior laryngeal branches, but also may send branches of ramification by way of the superior laryngeal ganglia.



NERVE SUPPLY OF THE THYROID BODY.

CHAPTER II.

NERVE SUPPLY TO THORACIC VISCERA.

WE will now turn our attention to the nerve supply of the thoracic cavity and viscera contained therein. The nerve supply to the thoracic cavity and organs is from different sources.

1. Branches from the cranial and from the cervical nerves directly affect the thoracic viscera from above, while the upper portions of the spinal cord, and also the thoracic portions of the gangliated cords, send branches which contribute to the nerve supply directly to the organs of the thoracic cavity.

2. From the lower thoracic and lumbar portions of the spinal cord we have connections with the phrenic and pneumogastric nerves, through which connection they influence the heart and other organs of the thoracic cavity.

We will now consider the nerve supply to the lungs, and especially is this an important matter because of the more common and prevalent diseases that affect the lungs.

Tuberculosis is the most common, most fatal infectious disease preying upon the human race. Tuberculosis is the direct or indirect cause of about one death in every seven. Diseases of the lungs of a fatal nature are more commonly due to tubercular infection than to any other exciting cause.

In the treatment of lung diseases, such as tuberculosis, asthma, pneumonia, or other ailments, it is quite essential to understand which nerves supply and ramify the lungs, and which nerves indirectly affect or influence the pulmonary organs.

Now, we cannot go into the etiology, pathology,

symtomatology, nor into an outline of the general methods of treatment of lung diseases, nor can we go fully into a description of the many nerves that may ramify or indirectly influence the lungs or organs of the thoracic cavity; but we want to enumerate the principal nerves and describe how they may reach and ramify or indirectly influence the pulmonary organs. We enumerate below the principal nerve supply to the pulmonary organs as follows:

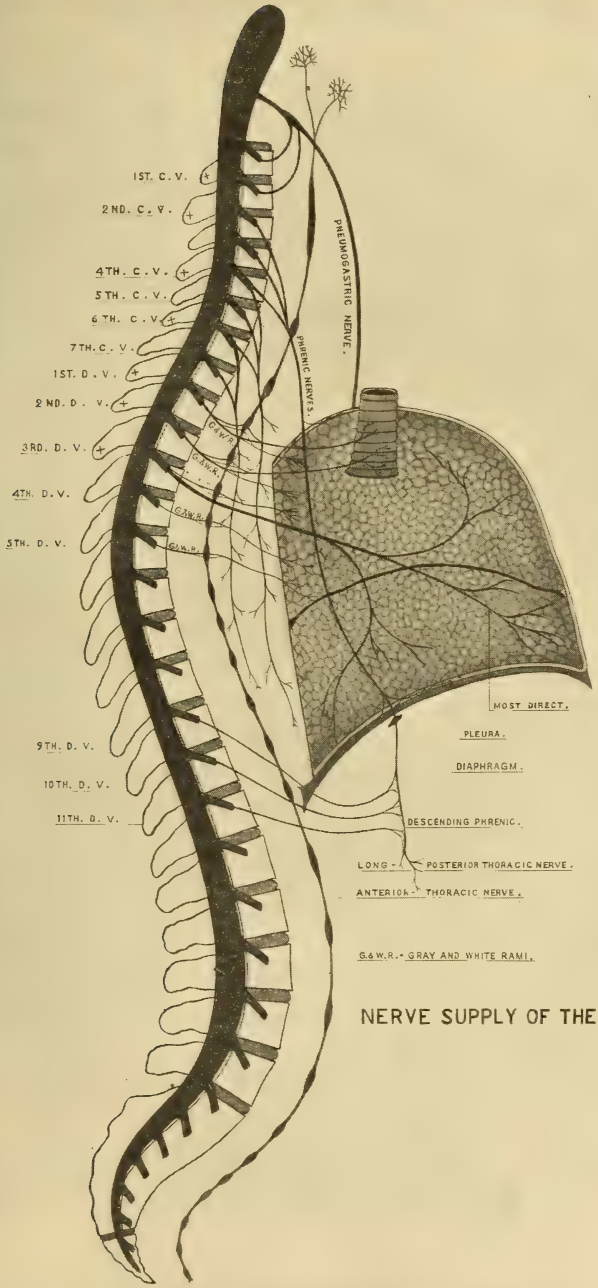
1. Pneumogastric.
2. First cervical nerves.
3. Fourth cervical nerves.
4. Fifth to eighth cervical nerves.
5. First and second thoracic nerves.
6. Third to the sixth thoracic nerves.
7. Ninth to the eleventh thoracic nerves.

The first pair of spinal nerves that may affect the lungs is the first pair of cervical nerves or the suboccipital pair of nerves.

First, these nerves join and help to form the recurrent meningeal nerves that directly supply the dura mater and deeper coverings of the brain. Through interference with the action of the suboccipital pair of nerves, the nutrition and function of the brain is interfered with, and as the centers for the control of all organs and parts of the body are mostly contained in the brain or encephalon, any interference with this organ may affect the lungs as well as many other organs or parts.

Second, the suboccipital pair of cervical nerves join the vagus or pneumogastric pair of nerves. The pneumogastric pair of nerves, as the name implies, ramifies and supplies the lungs as well as the heart and also other viscera of the thoracic and abdominal cavities.

Any interference with the pneumogastric pair of nerves, either through disturbance of the brain or its meninges, from interference with the recurrent me-



NERVE SUPPLY OF THE LUNGS.

ningeal nerves, or through interference with the nerves joining the pneumogastric, as from the suboccipital nerves, will interfere with the pulmonary organs to a greater or less extent.

The next pair of nerves in the cervical region affecting the lungs that we wish to call the reader's attention to, is the fourth pair of cervical nerves. From this pair of nerves originate the phrenic nerves principally; in fact, entirely, except auxiliary branches from the third and fifth pair of cervical nerves.

The ramification of the phrenic nerves have a direct effect upon the pulmonary organs because of their distribution to the pleura, pericardium, diaphragm, etc.

These nerves have a direct effect upon respiration by affecting the expansion of the pleura and diaphragm, and they are known as the internal respiratory nerves of Bell.

By affecting the respiration and the expansion of the pulmonary organs, they affect, indirectly, the circulation of the cranial cavity, and we may relieve the congested condition of the brain by stimulating or removing interference with the fourth pair of cervical and phrenic nerves.

The next pair of nerves to which we would call your attention that may indirectly affect the lungs, affect the respiration by effecting the expansion of the chest; these are the external respiratory nerves of Bell, arising from the fifth and sixth cervical pair of nerves, namely: The long, or posterior thoracic nerves, and the anterior thoracic nerves, both external and internal branches. These nerves supply the muscles that assist in the expansion of the chest by supplying motor impulses to the respiratory muscles of the thoracic cavities.

The long, or posterior thoracic nerves, supply the serratus magnus muscles which attach to the ribs throughout the thoracic region from the first down to, and including the eighth pair of ribs, while the anterior thoracic nerves pass under and supply the pectoral

muscles, both major and minor. Thus these principal muscles of respiration are supplied by and affected by interference with the brachial plexuses, and their roots of origin can be traced back to the fifth and sixth pairs of cervical nerves.

An understanding of the ramification of the branches of the fifth and sixth cervical pairs of nerves, especially an understanding of the ramification of the long or posterior thoracic nerves, will explain to us how we may often relieve what seems to be an intercostal neuralgia, by relieving impingement of the fifth and sixth pairs of cervical nerves, and also explains some peculiar nerve tracings that are made by careful students or adjusters.

In passing, we would call attention to the second pair of thoracic nerves. These nerves affect the bronchial tubes. They also affect the heart, and for the above reason they have an effect upon any cough. They may affect the lungs, heart, and circulation, but their influence upon the lungs is far overshadowed by that of the third pair of thoracic nerves, which ramify more directly the lungs and pleura. The upper portions of both the right and left lung are supplied by the third pair of nerves, also the central part of the upper portion of both lungs.

The third pair of nerves almost wholly supply the pleuras from the top to the bottom, throughout their entire extension.

They have the most effect, and ramify most completely, the lungs and pleura of any nerves; for that reason their condition is most important in all cases of lung trouble, as well as in most cases of asthma.

We have been told by one who claims to have paid very close attention, that the third thoracic spinous process, in tubercular cases, is usually to the left. We also find that the apex of the left lung is usually involved first in lung trouble.

By Mr. Davenport we are told that in practically all

cases of consumption the patient has contracted the habit of continually lying upon the left side. This fact will explain to a certain extent why the left lung, being the dependent one, as the patient sleeps, is more apt to become involved with congestion and also with infection of any kind.

The fourth thoracic nerves have a direct influence upon the lung tissues. They supply the muscles of the heart and have a direct effect upon the circulation of the lungs, and branches from the fourth pair of thoracic nerves help to supply the lobes of the lungs through their connection with the fourth thoracic ganglia and with the cardiac plexus.

The fifth equally supply the lungs, because the branches of these join into the formation of the cardiac plexus, from which the lungs receive their direct supply; further, the fifth nerves seem to have the greatest effect upon the stomach, especially the nerves from the left side of the spine; consequently anything that stimulates or anything that will furnish normal impulses to the stomach will assist in the secretion of the juices aiding in the digestion, and also assist the peristaltic movements of the stomach.

Good digestion will help very materially in maintaining the nutrition and in the upbuilding of the patient. This metabolic stimulation will establish and increase the autoprotection that is necessary, that a patient may withstand the ravages and be equal to the task of overcoming the inroads of tubercular infection.

In this connection we would also call your attention to the fifth and sixth cervical pair of nerves which supply the thyroid glands. These nerves are important, and have a decided influence upon the lungs, because of their influence upon the thyroid glands. These glands secrete the colloid material which is thrown into the general circulation and which has a direct

influence upon the general metabolism of the organism. This will increase the building up of the cellular tissues of the body. Anything that will increase the tissues building will increase the power of resistance, and this vital resistance will aid materially in eradicating diseases of the lungs.

The sixth pair of dorsal nerves have a direct action upon the diaphragm, and also the sixth pair send branches to a certain extent, into both the cardiac and the solar plexuses of the sympathetic system, and therefore they influence the nerve supply of both the thoracic and abdominal cavities.

This pair of nerves also affects the general nervous system. Tubercular people are always neurasthenic. For this reason, when we affect the sixth pair of thoracic nerves and the sixth segment of the spinal cord, we will affect that nervous condition and strengthen up the nerve tone, and we thereby increase autoprotection and the vital resistance against the inroads of disease, and stimulate and build up the organs of both the abdominal and thoracic cavities.

Now, in the above, we have briefly enumerated the principal nerve supply to the lungs. There are other nerves that will affect the lungs. We may mention that the kidney action and the tenth pair of thoracic nerves that control the skin action, have a direct effect upon the lungs because of the elimination by them of the effete and waste matter.

Now the kidney and skin action are affected more from the tenth pair of thoracic nerves, probably, than any other one pair of nerves; since the tenth thoracic is central place for the skin action of the entire body. For this reason it is very important to remember that the tenth pair of thoracic nerves affect elimination in connection with all diseases of the lungs and of other organs or parts.

The ninth, tenth and eleventh thoracic nerves join the terminal fibers of the phrenic nerves. The phrenic nerves contain both afferent and efferent fibers; hence involvement of the ninth to eleventh pair of thoracic nerves will, through the afferent fibers of the phrenic nerves, influence the lungs. There seems to be a complication of the heart in most cases of kidney trouble which must be due to the communication of the nerves of the kidney region with the phrenic nerves, and it may be that the connection existing between lower thoracic nerves and the pneumogastric nerves is also responsible for involvement of the heart and lungs.

It is also a fact that if any pair of nerves is involved, it would cause an extra expenditure of nerve energy, as nerve energy is wasted thereby, and any weak organ in the body will be the loser, and suffer because of the lack of the generation of the proper amount of nerve energy to supply all the normal needs of the body, and also the extra supply for the waste.

In the treatment of cases of lung trouble we have had some remarkable results. We know that lung trouble will sometimes recover of its own accord. If it recovers unaided, will it not recover still better if we look after the nerve supply and remove all interference with the nerves that we have indicated above?

We are sure that our success in the treatment of this disease will warrant us in saying that most cases of lung trouble may be removed and the patient restored to health. We have taken some extreme cases, and we have never failed to get good results in any cases yet that we have accepted and put under treatment, and we feel that it is a great blessing to humanity to have some competent way or method of successfully treating by relieving the nerve supply to the lungs from every source.

The phrenic nerves also supply the pleura, thereby influencing the expansion of the lungs.

The phrenic nerves also supply the diaphragm, and thus exert an influence upon the expansion of the thoracic cavity. The latter two phenomena both influence the heart action to a certain extent.

The pneumogastric nerves are prime factors in the formation of the cardiac plexus. The pneumogastric nerves are affected directly by branches from the first and second pair of cervical nerves. For this reason, adjustment of the first and second cervical vertebræ will have a direct action upon the heart. This was demonstrated recently in the case of a man who, it was thought, had died on a street car, but who was restored quickly by an upper cervical adjustment.

The upper thoracic nerves enter directly into the formation of the cardiac plexus, and send branches directly to the terminal ganglia supplying the different organs of the thoracic cavity.

The second pair of thoracic nerves most directly influence the heart by stimulation of the vasomotor influences. Relief of the second pair of dorsal nerves will establish the normal impulses to the vasomotor nerve supply of the heart center and induce inhibitory control. The second thoracic nerves originate from a spinal segment immediately under the seventh thoracic vertebra, and the vasomotor action and inhibitory control may be obtained by concussion over the seventh cervical spinous process and the first and second thoracic. Percussion over the fourth and fifth cervical spinous process will stimulate vasomotor and vasoconstrictor action of the lungs.

If the nerves are free, we get the normal impulse and normal heart action, provided no trauma exists. If, at any time, we wish to increase the action and excite an increased inhibitory control, we may do so by adding to the normal impulse by stimulating the centers from which the fourth pair of thoracic nerves originate. The

centers of origin of the fourth pair of thoracic nerves are situated under the spinous process of the first thoracic vertebra.

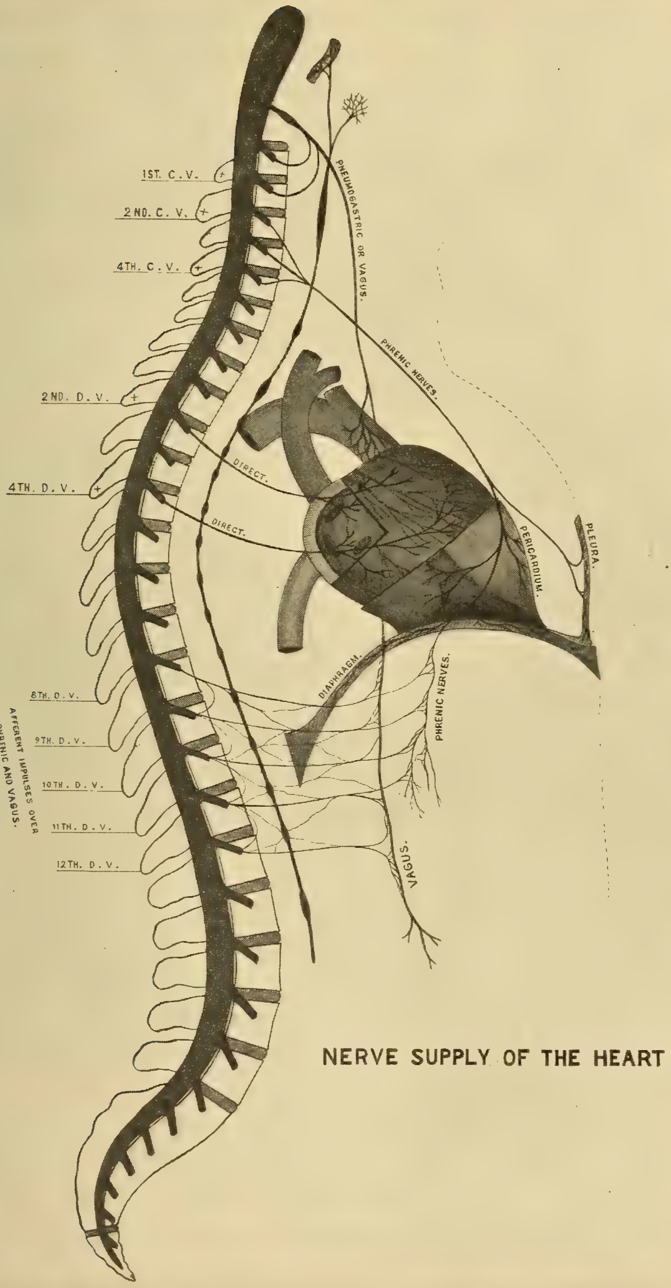
Nerve Supply to the Heart:

1. Phrenic.
2. Pneumogastric.
3. Upper thoracic.
4. Lower thoracic.
5. Middle cervical ganglia.
6. Inferior cervical ganglia.
7. Superior cervical ganglia.

The nerve supply to the heart is quite important; somewhat complicated, but for various reasons it should be thoroughly understood; and further, we should understand the nerves ramifying and supplying the heart directly, and then those influencing it indirectly.

We find it quite necessary to have a thorough knowledge of those centers or segments in the spinal column giving off nerves that have a vasomotor effect upon these organs, also those centers giving off nerves having an inhibitory, and also those having a vasodilator effect upon the lungs and heart. The centers giving off nerves that have a constrictor influence upon the heart and aorta, are especially important in the treating of aneurism of the aorta. The centers giving off nerves having a vasodilator effect, are more important in the treatment of asthma and angina pectoris, and also all diseases of a spasmodic nature of the thoracic region.

Phrenics.—The phrenic nerves are given off principally from the fourth pair of cervical nerves, but auxiliary branches from the third and fifth cervical nerves enter into their formation. The phrenic nerves enter also into the formation of the cardiac plexus, and have an important influence upon the nerve supply to all of the viscera of the thoracic cavity. They especially supply the pleuras, pericardium, and the diaphragm. The phrenic



NERVE SUPPLY OF THE HEART.

nerves control to a great extent the expansion and contraction of the parts mentioned and their action decidedly influences the integrity of the heart's action.

The method of resuscitating people who have become unconscious from sudden paroxysms, consists of tapping or percussing with the hands over the spinous processes of the fourth or fifth cervical vertebra.

Pneumogastric.—The pneumogastric nerves directly influence the heart action. The pneumogastric nerves become affected by interference with the upper two cervical nerves which give off communicating branches that join them.

Adjustment of the upper cervical vertebræ has restored patients to consciousness, because of this connection.

Upper Thoracic.—The upper thoracic nerves have the most potent influence upon the heart. They supply most directly branches to the heart muscles. The second pair of nerves exert a vasomotor and vasoconstrictor influence upon the heart and aorta.

Cases of thoracic and abdominal aneurism have yielded to the influence of a thrust to remove interference with the second pair of thoracic nerves. Cases of aneurism have also been restored to normal by percussion of the spinal centers from which originate the second pair of thoracic nerves.

The centers of origin of the second pair of thoracic nerves are situated under the seventh cervical vertebra. According to Dr. Albert Abrams, percussion to constrict the heart and aorta should be given over the seventh cervical spinous process.

The fourth pair of thoracic nerves directly ramify the muscles of the heart and have a direct inhibitory action as well as a vasomotor influence upon the heart.

We have restored the heart beat after cessation from

chloroform by a thrust to relieve the fourth pair of thoracic nerves.

We may influence the heart's action by relieving the fourth pair of thoracic nerves and by so doing we restore the normal impulse to the heart.

We may stimulate these same nerves by percussion immediately over the spinal centers from which the fourth thoracic nerves are derived. To do so, percussion should be applied over the first and second thoracic vertebræ or spinous processes thereof. By understanding and operating upon these centers as above indicated, we have been able to reduce the heart beat from 100 to normal in from five to seven minutes' treatment, and the normal condition will be resumed in from thirty minutes to an hour after treatment.

The lower thoracic nerves have an influence upon the heart action, and upon all organs of the thoracic cavity. The connection, however, seems to be due to the communication existing between the lower thoracic nerves and the terminal fibers of the phrenic nerves.

The influence produced in the lower thoracic is quite different from that produced in the upper thoracic. While the upper thoracic supplies the vasomotor and inhibitory control, the lower thoracic supplies the vasodilator influences. If we have the normal nerve supply from the two regions, we have an equilibrium existing between the vasoconstrictor and vasodilator influences; consequently the normal condition. However, should we have a condition of vasodilation of the heart or the thoracic organs because of interference with the lower thoracic nerves, then all we need to do is to relieve the lower thoracic from the interference and establish the normal equilibrium.

On the other hand, if we wish to obtain above the normal vasodilator influences, then it is necessary in addition to freeing the nerve from interference, to stimu-

late the centers from which they are derived, and thus stimulate the motor roots of the nerves. This will increase the vasodilator action, provided we are treating in the lower thoracic region.

The superior, inferior, and middle superior cervical ganglia of the gangliated cords, enter into the formation of the cardiac plexus, and directly supply the heart's action, and also exert an influence on all of the thoracic viscera. Their action seems to be vasomotor and vaso-constrictor in influence.

Stimulation of the inferior cervical ganglia by percussion over the seventh cervical vertebræ will excite constriction, and increase the vasomotor effects upon the heart and aorta.

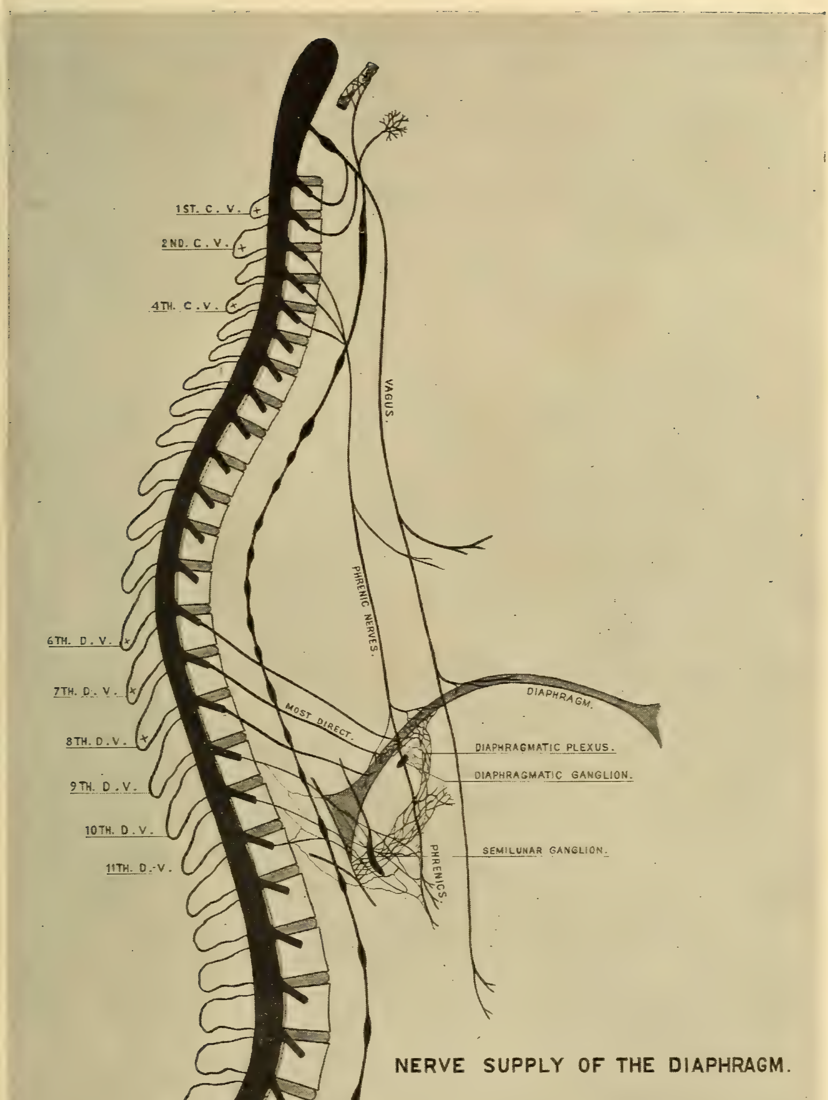
There is also no doubt that any intense pain anywhere in the body will produce a reflex or sympathetic influence upon the heart's action. The gray rami branches from the upper thoracic ganglia of the gangliated cords of the sympathetic system, enter into the formation of the cardiac plexus, and therefore become factors in influencing the organs supplied thereby; consequently have an influence upon the heart's action.

NERVE SUPPLY TO THE DIAPHRAGM:

1. Phrenic.
2. Pneumogastric.
3. Lower thoracic.
4. Middle thoracic.
5. Diaphragmatic plexus.

The phrenic nerves furnish a very direct and a very considerable portion of the nerve supply to the diaphragm and they come from the middle cervical region. The phrenic nerve supply is disturbed by spinal lesions interfering with the middle cervical nerves.

The vagus nerves help to form the diaphragmatic plexus of the sympathetic, and also give branches to the diaphragm direct.



NERVE SUPPLY OF THE DIAPHRAGM.

The middle thoracic region, by direct ramification, supplies the diaphragm, and the supply seems to come from about the sixth and seventh thoracic nerves, while the lower thoracic nerves communicate with the phrenic nerves and influence the diaphragm, and also send branches into the formation of the diaphragmatic plexus of the sympathetic. The diaphragm receives branches also from the ganglia of the middle portion of the gangliated cords.

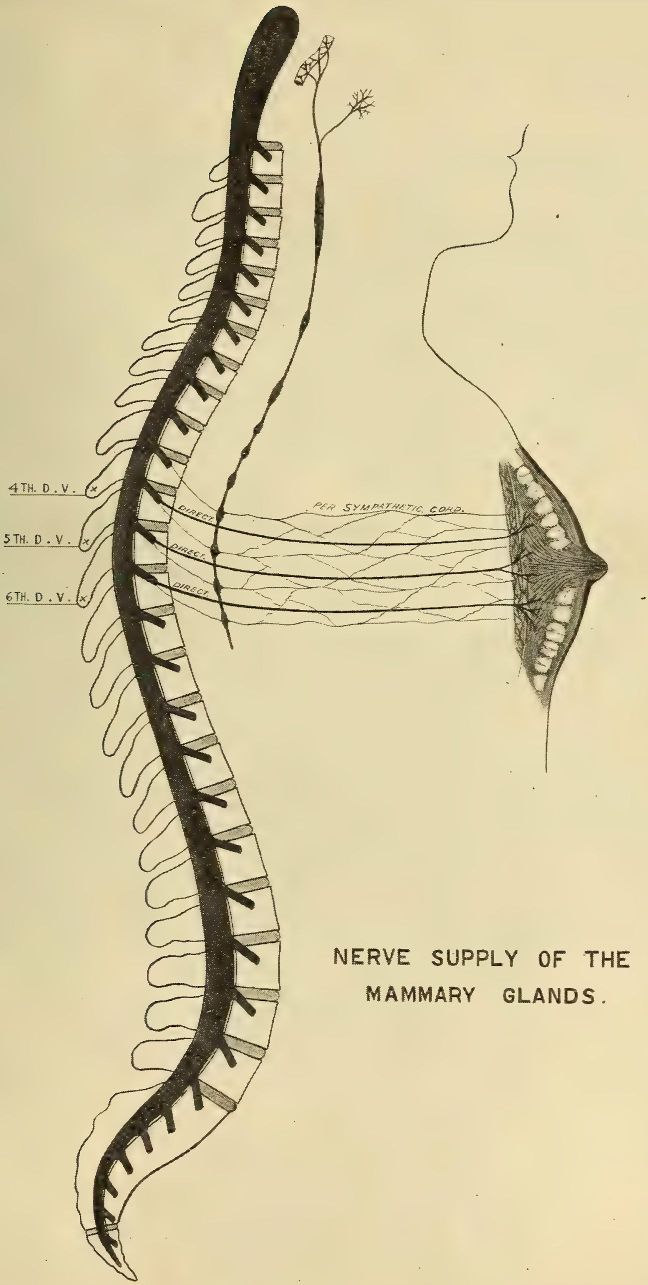
The Esophagus.—The esophagus receives its nerve supply from the esophageal plexus, which is a terminal ganglia of the cardiac plexus of the sympathetic; it also receives white rami from the cervical nerves and the upper thoracic nerves, while the upper portion is supplied by the terminal ganglia of the cervical region.

The thoracic aorta is supplied by the second, third and fourth thoracic nerves principally. The second thoracic nerves have a vasoconstrictor influence upon the aorta. Removing all interference with the second thoracic nerves gives us the normal constrictor influence upon the thoracic aorta, and they also influence the abdominal aorta.

If at any time we wish to have more than the normal influence, which is necessary sometimes in aneurism, we may then enhance the constrictor influence by percussion over the seventh cervical vertebra. Thereby we stimulate the roots of efferent nerves that form the second pair of thoracic nerves.

Nerve Supply to the Mammary Glands.—The nerve supply to the mammary glands is from the intercostal nerves that are given off from about the third to the fifth pair of spinal nerves inclusive.

The sympathetic supply to the mammary glands is from the gray rami of the upper thoracic segment of the gangliated cords of the sympathetic by way of the gray rami branches, to the intercostal nerves.



NERVE SUPPLY OF THE
MAMMARY GLANDS.

Another important division of the nerve supply to the mammary glands is the nerves which come from the brachial plexus. The brachial plexus gives off branches that supply both the back and the front of the chest. The intercostal nerves in front, both external and internal, enter into the supply of the mammary glands, and the long posterior thoracic gives branches to the axillary portion of the mammary glands, and especially to the glands of the axillary region.

Affections of the breast may come, then, from interference with nerves of the cervical region, especially the lower portion thereof, and from the thoracic region down to as low as the sixth pair.

In the treatment of the diseases of the breast, it is well to look after the nerve supply from each segment of the spine that contributes to the supply of the mammary glands. If we should fail to do this, and confine our treatment to one spinal segment, we might miss other lesions that interfere with the integrity of other nerves that enter into the supply of the mammary glands. In this way we may fail to remove the nerve interference that may cause a continuation of the pathological process in diseases of the mammary glands.

CHAPTER III.

NERVE SUPPLY TO ABDOMINAL VISCERA.

THE nerve supply to the viscera of the abdominal cavity is given off and supplied most directly from the lower thoracic portion of the spinal cord and lower thoracic portion of the gangliated cords of the sympathetic. All the nerves from these regions, from the sixth thoracic segment, down to and including the last thoracic segment, enter into the formation of the solar plexus, and ramify and mostly supply the viscera of the abdominal cavity.

The abdominal organs are no exception to the general rule; consequently we find the nerve supply coming from different portions of the cerebro-spinal system and entering into the formation of the solar plexus, and helping to supply the viscera and organs of the abdominal cavity.

The branches that come from other regions than those located approximate to the abdominal organs, do not have as decided an effect upon these organs as do the nerves from the lower thoracic portions of the spinal cord and sympathetic cords.

We find that by means of an anastomosis existing between the pneumogastric and phrenic nerves supplying the abdominal organs from above, that the abdominal viscera are supplied and affected from both the nerves of the cranium and upper or cervical portion of the spinal cord. There is, also, an intermingling and communication existing between the lumbar and sacral nerves below, with the terminal branches of the pneumogastric nerve from above, consequently the lumbar and sacral nerves also have an influence upon the viscera of the abdominal cavity.

The abdominal viscera, like those of the thoracic cavity, apparently receive their nerve supply from the terminal ganglia given off from the solar plexus. As the solar plexus and terminal ganglia also depend upon physiological impulses received from the brain and spinal centers, we find it necessary to study from what points of the spinal cord we would be enabled to influence the function of the sympathetic ganglia.

In the arrangement of the nerve supply affecting the viscera of the abdominal cavity, we find that same precautionary arrangement as in the thoracic cavity whereby an organ is not deprived of its nerve impulses and consequent vitality and functional activity, because of interference with any one pair of nerves. This is because the auxiliary supply from other segments of the cerebrospinal system will maintain the life, and, perhaps, in a manner, maintain the functioning of the organ to a limited extent, although the more direct nerve supply might be interfered with or cut off.

The fact that the viscera of the abdominal cavity do receive a nerve supply from different segments and portions of the cerebro-spinal system, emphasizes the necessity of removing spinal lesions in all portions, that all nerve supply may be free from interference to all the organs of this cavity.

We notice one important change taking place in the arrangement, or relative arrangement of the centers exerting the vasomotor influences upon the viscera of the abdominal cavity, as compared with the viscera of the thoracic cavity, described above.

In the thoracic cavity, the segments of the spinal cord which produce vasoconstrictor influences, are above those centers which produce the vasodilator influences. For example, we would produce vasoconstrictor influences on the heart from the upper thoracic, as, for example, we would produce vasoconstrictor influences by

adjustment of the second thoracic vertebra, or by percussion over the seventh cervical vertebræ, while we produce vasodilation by adjustment of or percussion over the lower thoracic vertebræ.

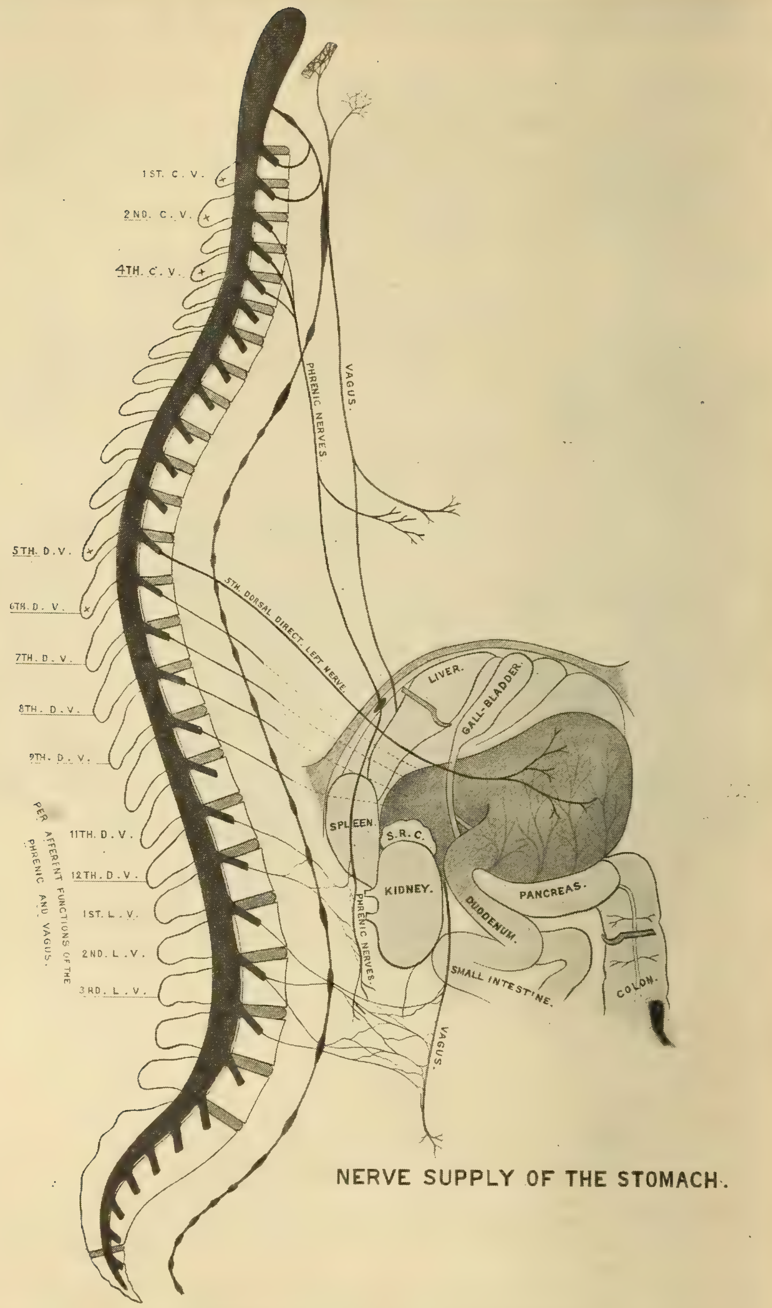
When we pass below central place, or the sixth thoracic, we find a different relative arrangement of the vasomotor and vasoconstrictor centers influencing the viscera supplied. We find that the constrictor centers, instead of being located above the vasodilator centers as in the arrangement of the nerve supply to the viscera of the thoracic region, are situated below the centers, which induce vasodilation. This will be brought out as we study the influence of the spinal segments relative to their action upon the viscera supplied in the abdominal cavity.

Nerve Supply to the Stomach.—The nerve supply to the stomach comes from, and is influenced by nerves from several different segments and portions of the spinal column. We will enumerate below the nerves that directly or indirectly supply and influence the stomach and impingements affecting the integrity of nerve supply to it:

1. Phrenic.
2. Pneumogastric.
3. Upper cervical.
4. Middle cervical.
5. Middle thoracic.
6. Lower thoracic.
7. The upper lumbar.

In the above enumeration we see that the nerve supply of the stomach comes from both the cervical and thoracic segments of the spinal cord, we have also a nerve supply from the lower thoracic region direct, through the afferent fibers of the pneumogastric and the consequent reflex influence.

The pneumogastric or vagus is quite an important



NERVE SUPPLY OF THE STOMACH.

factor in the nerve supply to the stomach. In mentioning the portions of the spinal cord that influence the stomach, we include those portions that also influence the vagus nerve. The vagus nerve itself is not a matter of important consideration in spinal treatment, except as we influence or stimulate it directly in the cervical or other regions.

We have a direct influence upon the stomach by the nerve supply furnished through the splanchnic nerves, which enter into the formation of the solar plexus and other gray rami from the abdominal division of the gangliated cords of the sympathetic. This portion of the sympathetic enters directly into the nerve supply of all the viscera of the abdominal cavity, therefore in this connection we wish to investigate the spinal segments that influence the functional activity of the abdominal viscera in general, or that influence the sympathetic ganglia which furnish the nerve supply to the different viscera.

Upper Cervical Nerves.—The upper cervical nerves do not themselves directly ramify any of the viscera of the abdominal cavity, except they influence them indirectly by sending anastomotic branches into the pneumogastric. By means of this connection, the vital activity and integrity of the pneumogastric nerves are materially affected; therefore lesions affecting the integrity of the upper cervical nerves, will also affect the functional action of the pneumogastrics which exercise a direct influence upon the viscera of the abdominal cavity.

Middle Cervical Nerves.—The fourth pair of cervical nerves, together with an auxiliary branch from the third and fifth pair of cervical nerves, form the phrenic nerves on either side, which enter into the formation of the solar plexus after supplying the pericardium, pleuras, and diaphragm.

The lower terminal fibers of the phrenic nerves ramify the adrenal ganglia. Because of the connection with the

phrenic nerve with the above and with the solar plexus, interference with the integrity of the middle cervical nerve influences, to a limited extent, the functional activity of the supra-renal capsules and the stomach.

Middle Thoracic Nerves.—From the middle thoracic nerves we have our most direct nerve supply to the thoracic cavity. These nerves affect the stomach through the influence they exert upon the solar plexus, and also these nerves directly supply the terminal ganglia of the stomach.

The most direct and potent influence upon the stomach seems to form the fifth pair of thoracic nerves and from the left side, but we may discover a decided influence on the stomach from the fifth down to and including the eighth pair of thoracic nerves.

Most of our stomach troubles are readily relieved by adjustment to relieve interference with the fifth and sixth thoracic pairs of nerves. The nerve supply to the stomach, as we will notice, is from the central segments of the thoracic region. From this region, reflex excitations originating within and coming from stomach irritations, produce decided influences upon the central nervous system because of their proximity to the central place of the spinal cord.

The contents of the stomach will often excite incoordinate reflex phenomena under certain conditions. Children who eat food which disturbs the stomach, are apt to be thrown into general spasms or convulsions.

Lower Thoracic Nerves.—We notice another very interesting arrangement as to the source of the nerve supply exciting the different phases of the vasomotor effects upon the abdominal viscera.

Adjustment of the twelfth thoracic produces a vasodilator influence upon the stomach, while percussion over the ninth thoracic vertebræ will stimulate the origin of

the motor nerves that excite the vasodilator influence upon the stomach and adjacent viscera.

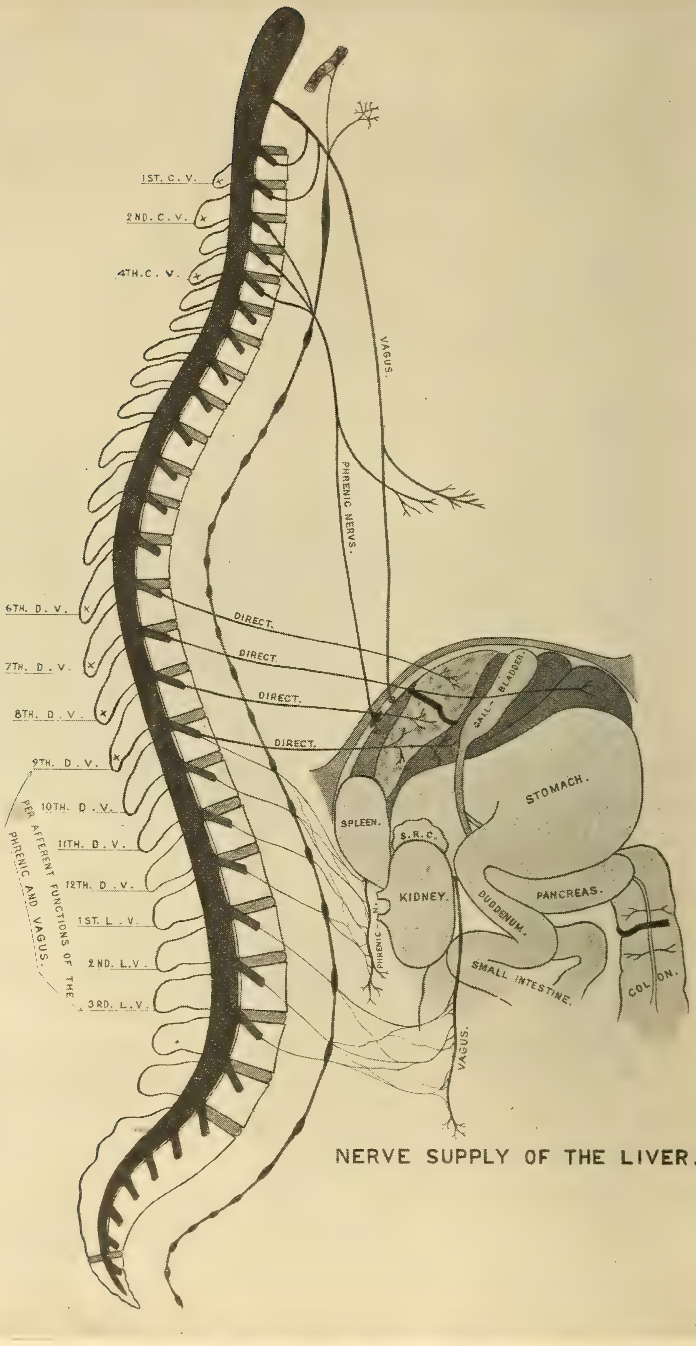
Lumbar Nerves.—We find that percussion over the first and second lumbar will produce a vasoconstrictor effect upon the stomach. Now in this arrangement we have the reverse of that which we noticed in the supply of the thoracic viscera. Here we have our vasodilator centers situated in a higher segment than are the centers giving off the vasoconstrictor nerve supply.

There is this similarity, though, about the arrangement of the vasoconstrictor and vasodilator centers in these different regions. In both regions we find that the vasodilator influences are more nearly the central portion of the thoracic segments of the spinal cord, while the centers supplying the vasoconstrictor nerve supply are more distant from the central segments of the spinal column.

We also have an influence acting directly upon the stomach by way of the pneumogastric nerves, but in such cases the impulses come from the lumbar region below. This is because of an intermingling and communication of the lumbar nerves with the terminal filaments of the pneumogastric in the hypogastric or pelvic plexus.

Because of this connection, we have pelvic disturbances exciting certain influences upon the stomach. For example: In gestation we frequently have nausea and vomiting.

Nerve Supply to the Liver.—The nerve supply to the liver in many respects is similar to the nerve supply of the stomach. Practically the influences exerted upon the stomach from the different segments of the spinal cord, are duplicated in the phenomena witnessed upon the action of the liver. We might enumerate the nerves entering into and supplying directly and indirectly the liver, as follows:



NERVE SUPPLY OF THE LIVER.

1. Phrenic.
2. Pneumogastric.
3. Upper cervical.
4. Middle cervical.
5. Middle thoracic.
6. Lower thoracic.
7. The upper lumbar.

The Pneumogastric.—The influence upon the liver by the pneumogastric is effected by its connections with the upper cervical nerves, the result being very much the same as the effect upon the stomach.

The Phrenic Nerve.—Lesions of the middle cervical region will interfere with the phrenic nerves, and consequently excite a direct influence upon the liver.

Middle Thoracic Nerves.—In the middle thoracic nerves, we have quite a different arrangement of the nerve supply to the stomach and liver, as follows:

The stomach receives its nerve supply almost wholly from the left side of the spinal column, while the liver receives its nerve supply from the right side of the spinal column. As the two organs are situated approximate, and about in the same level, the nerve supply is from practically the same regions, we may expect to witness some derangement of the liver from any agency affecting the integrity of the spinal nerves on the right side, from the fifth or sixth down to and including the eighth.

The splanchnic nerves have a direct influence upon the liver. Percussion over the first and second lumbar spinous processes will excite a vasoconstrictor influence upon the liver and adjacent organs.

Upper Lumbar Nerves.—Adjustment of the fourth and fifth lumbar vertebræ would influence the same nerves as are influenced by percussion over the first and second lumbar, but not in the same way. By relieving the fourth and fifth nerve by adjustment, we establish the normal flow of physiological impulses, but by per-

cussion over the first and second lumbar we produce or incite a very greatly increased activity of the same nerves. Lumbar nerves affect the stomach and liver through the afferent terminal branches of the pneumogastrics.

Nerve Supply to the Spleen.—The spleen, stomach and liver are closely associated, consequently the different segments of the spinal cord that influence the stomach and liver, affect in the same way the spleen. The spleen, then, will be influenced by lesions in the following regions in the spinal column, which are the same as the one named above:

1. Phrenic.
2. Pneumogastric.
3. Upper cervical.
4. Middle cervical.
5. Middle thoracic.
6. Lower thoracic.
7. The upper lumbar.

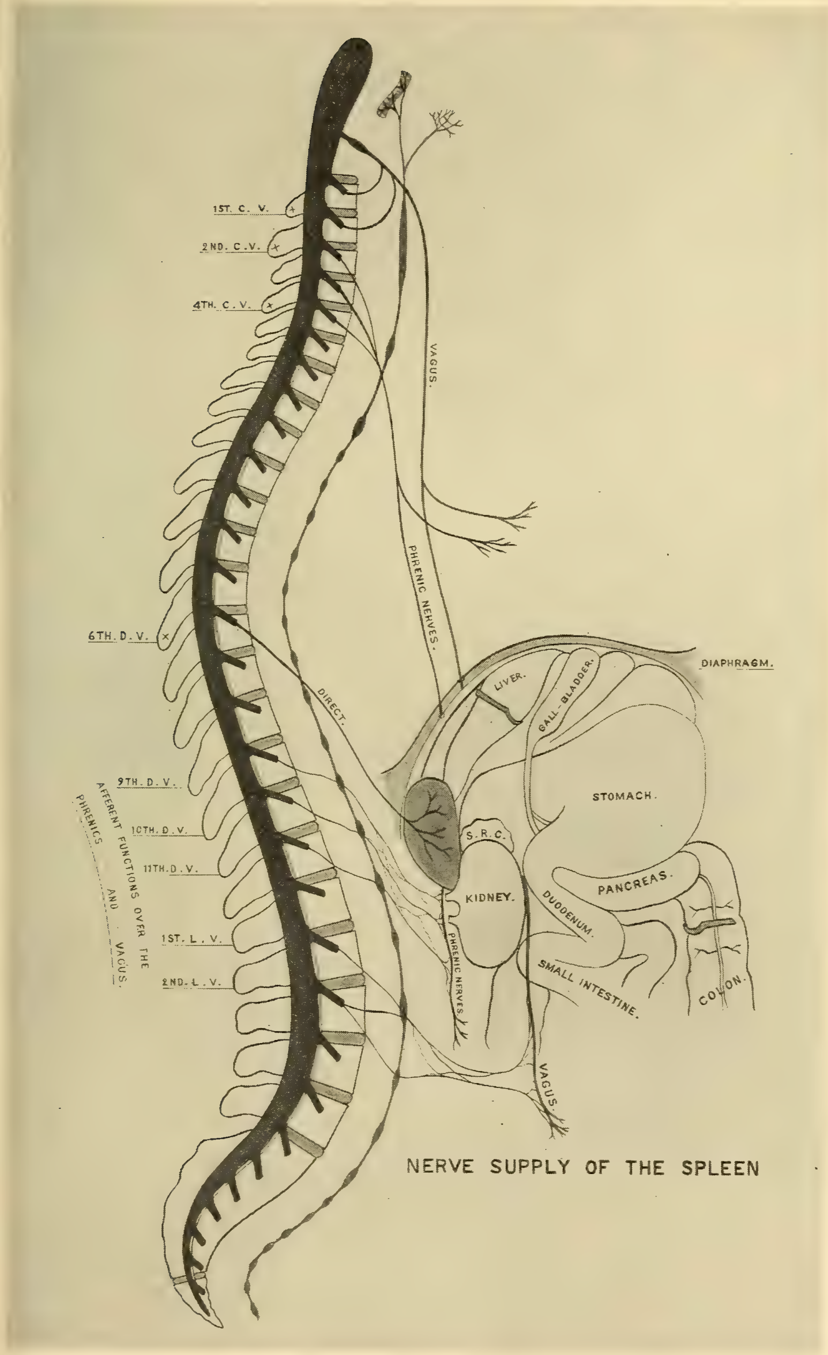
The influence of the middle and upper cervical portions of the spinal column affects the spleen through the phrenic and pneumogastric nerves in the same way as the liver and stomach are affected.

The most direct supply to the spleen is from the sixth segment of the spinal cord by way of the sixth thoracic pair of nerves and through the nerve from the left side.

Vasodilator influences are exerted upon the spleen through stimulation over the lower vertebræ of the thoracic region, from about the ninth to the eleventh, or by adjusting of the upper lumbar.

Vasoconstrictor influences are excited by percussion over the first and second lumbar, or they are permitted by adjustment of the lower lumbar.

The vasomotor influences upon the spleen are exerted in the same way and from the same regions of the spine as are the vasomotor effects upon the stomach and upon the liver, the only difference between the liver and the



NERVE SUPPLY OF THE SPLEEN

spleen being that the spleen receives its nerve supply from the left side or left spinal nerve, and from a less number of segments of the spinal cord, while the liver receives its nerve supply from the right side, but more spinal segments contribute nerves to its supply.

Nerve Supply to Pancreas and Adrenals.—These organs receive their principal nerve supply from the splanchnic nerves and from terminal plexuses given off from the solar plexus. The phrenic and pneumogastric nerves from the cervical and cranial regions join the solar plexus, but the direct nerve supply affecting these organs is from the lower thoracic region. We may enumerate the nerves that supply the pancreas and adrenals as follows:

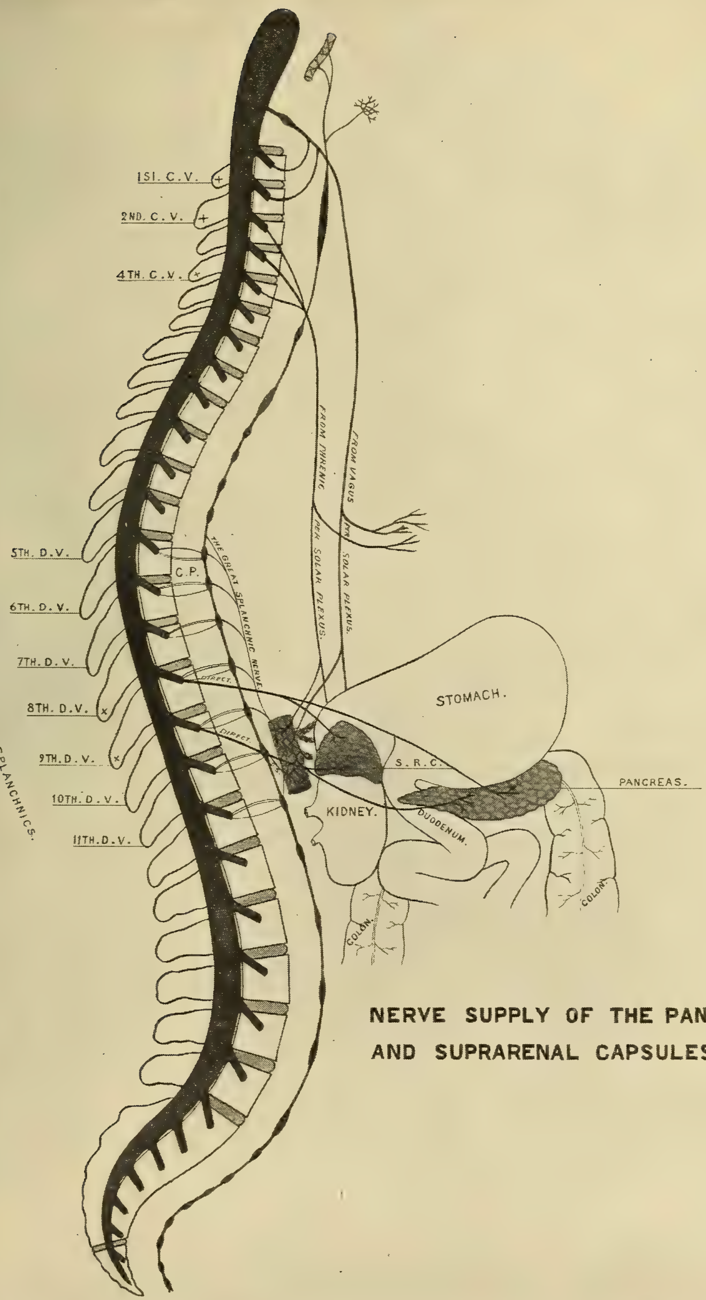
I. Phrenic.
II. Pneumogastric.
III. Eighth thoracic nerves.
IV. Ninth thoracic nerves.

The eighth pair of thoracic nerves join the sixth pair of thoracic nerves on the left side of the spine to form a plexus which supplies the spleen and pancreas.

The eighth thoracic nerves on the right side enter most directly into that portion of this plexus which supplies the pancreas.

The illustration represents the eighth thoracic nerve making its exit below the eighth thoracic vertebra and supplying both the suprarenal capsules and pancreas, but the eighth thoracic nerves do not materially affect the suprarenal capsule.

The ninth thoracic nerves, on either side, have a most direct and positive influence upon the adrenals, and in these organs the fibers of the ninth pair of thoracic nerves join the terminal branches of the phrenic nerves and they reflexly affect the fourth pair of cervical nerves and consequently the organs which they supply.



NERVE SUPPLY OF THE PANCREAS AND SUPRARENAL CAPSULES.

NERVE SUPPLY TO THE KIDNEYS.—The nerve supply to the kidneys is from:

1. Phrenics.
2. Pneumogastric.
3. Lower thoracic.
4. Lower thoracic ganglia.
5. Least splanchnic nerves.

The integrity of the functional activity of the renal organs is affected by lesions of the spinal column interfering with the exit of nerves in the following regions:

1. Upper cervical.
2. Middle cervical.
3. The lower thoracic.

The supply by way of the pneumogastric is the same as to the stomach, liver, and spleen.

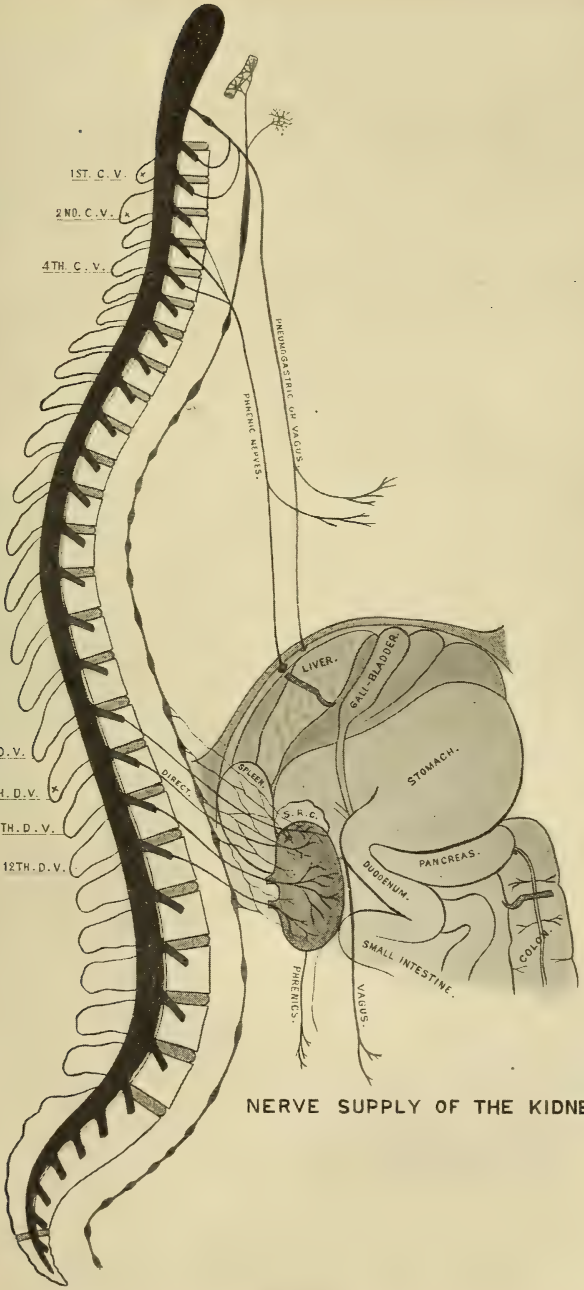
The supply from the middle cervical region of the spinal cord is through the phrenic nerves. The phrenic nerves, however, give their terminal fibers to the suprarenal capsules of the kidneys, and for this reason the phrenics affect only the adrenals.

The lower thoracic nerves, from the ninth to the twelfth pair, inclusive, affect the kidneys, but the more direct effect of spinal nerves is through the tenth pair of thoracic nerves.

The twelfth pair of thoracic nerves send white rami into, and form the third, or least splanchnic, and also directly affect the renal terminal ganglia of the solar plexus.

The kidneys are situated on both sides of the lower abdominal cavity and for this reason interference with the integrity of the nerves from either side supplying the kidney region, will affect the functional activity of the kidneys.

From the above we can see that, through the connection of the lower thoracic nerves with the phrenic nerve, the kidneys may reflexly affect respiration, and also



NERVE SUPPLY OF THE KIDNEYS

through the phrenic nerves and through the pneumogastric nerves, kidney lesions may reflexly affect the functions of the heart. We often have associated with kidney trouble certain cardiac derangements, which is no doubt due to the nerve connections between the lower thoracic vertebræ and the phrenic and pneumogastric nerves. Eye troubles associated with kidney disease are because of the nerve connections between the phrenic and lower thoracic.

Nerve Supply to the Small Intestines.—The nerve supply to the small intestines is from the following sources:

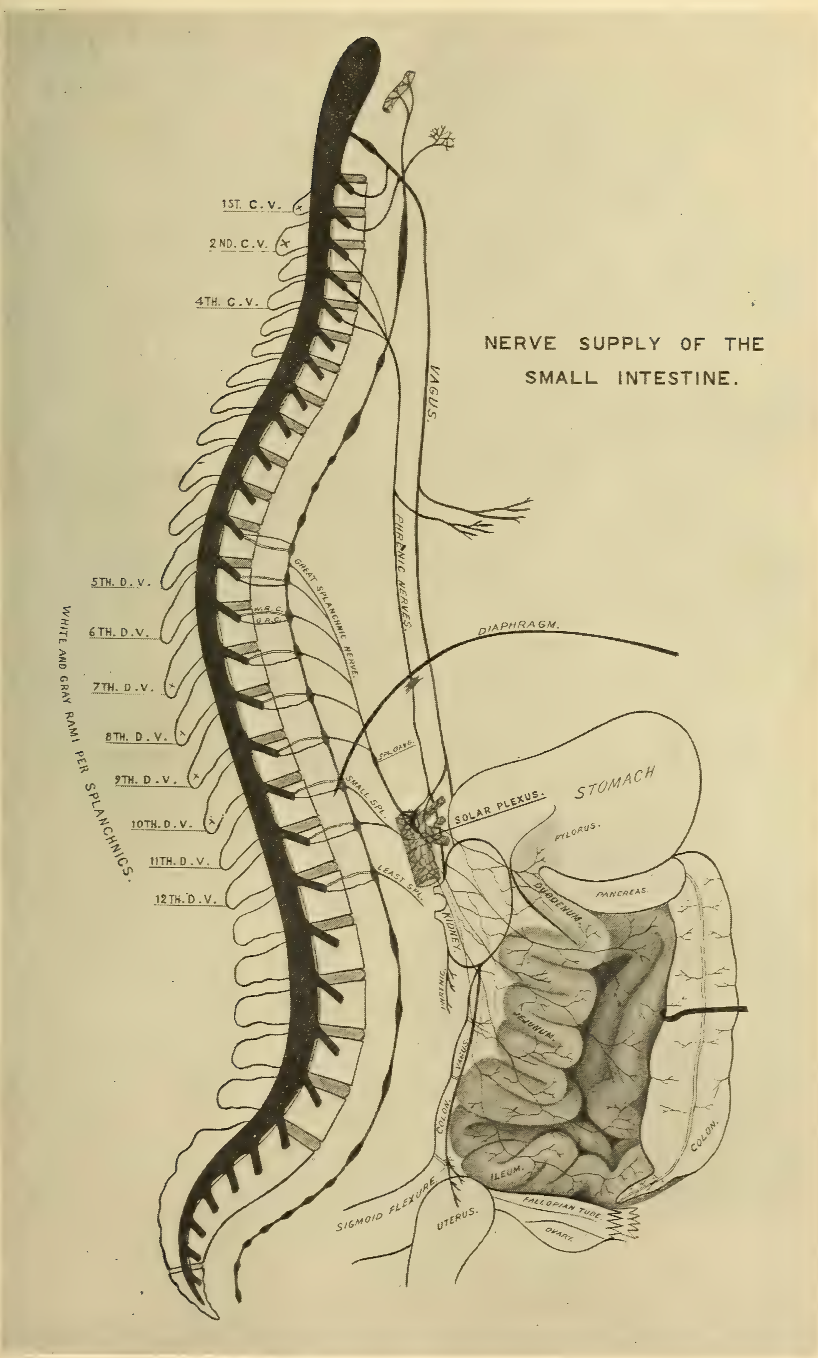
1. Phrenics.
2. Pneumogastrics.
3. Great splanchnics.
4. Least splanchnics.
5. Lesser splanchnics.
6. The upper lumbar nerves.
7. Thoracic rami communicantes.

The special spinal lesions that may interfere with the integrity of the nerve supply to the small intestines may be in any of the following portions of the spinal column:

1. Upper cervical.
2. Middle cervical.
3. Lower six thoracic.
4. Upper two lumbar nerves.

Spinal lesions in the upper portion of the cervical region will interfere with the pneumogastrics, while spinal lesions in the middle cervical region will interfere with the phrenics, and their terminal fibers extend as low as the suprarenal capsules of the kidney.

The lower six thoracic nerves enter into the formation of the splanchnic nerves. The great splanchnic nerves come from the fifth or sixth down to and including the ninth thoracic ganglia and spinal nerves, and therefore


NERVE SUPPLY OF THE
SMALL INTESTINE.
1ST. C.V.
2ND. C.V.
4TH. C.V.
5TH. D.V.
6TH. D.V.
7TH. D.V.
8TH. D.V.
9TH. D.V.
10TH. D.V.
11TH. D.V.
12TH. D.V.
WHITE AND GRAY RAMI PER SPLANCHNICS.
VAGUS.
PHRENIC NERVES.
GREAT SPLANCHNIC NERVE.
W.R.C.
G.R.C.
DIAPHRAGM.
SPL.GANG.
SMALL SPL.
LEAST SPL.
SOLAR PLEXUS.
STOMACH
PYLORUS.
PANCREAS.
DUODENUM.
KIDNEY.
JEJUNUM.
VAGUS.
COLON.
COLON.
ILEUM.
SIGMOID FLEXURE.
UTERUS.
FALLOPIAN TUBE.
OVARY.

the great splanchnic supplies the greater portion of the small intestines.

The lesser splanchnic nerves come from the tenth and eleventh pairs of thoracic ganglia, and they also supply a portion of the intestines and peritoneum, while the least splanchnic nerves come from the twelfth thoracic ganglia and supply the lower portion of the small intestines.

The lumbar nerves exert some influence upon the functional activity of the small intestines. Percussion of the upper lumbar will excite vasoconstrictor influences upon the vascular supply, and vasomotor influences upon the muscular walls of the small intestines.

Nerve Supply to the Large Intestines.—The large intestines may be influenced by lesions in the following locations:

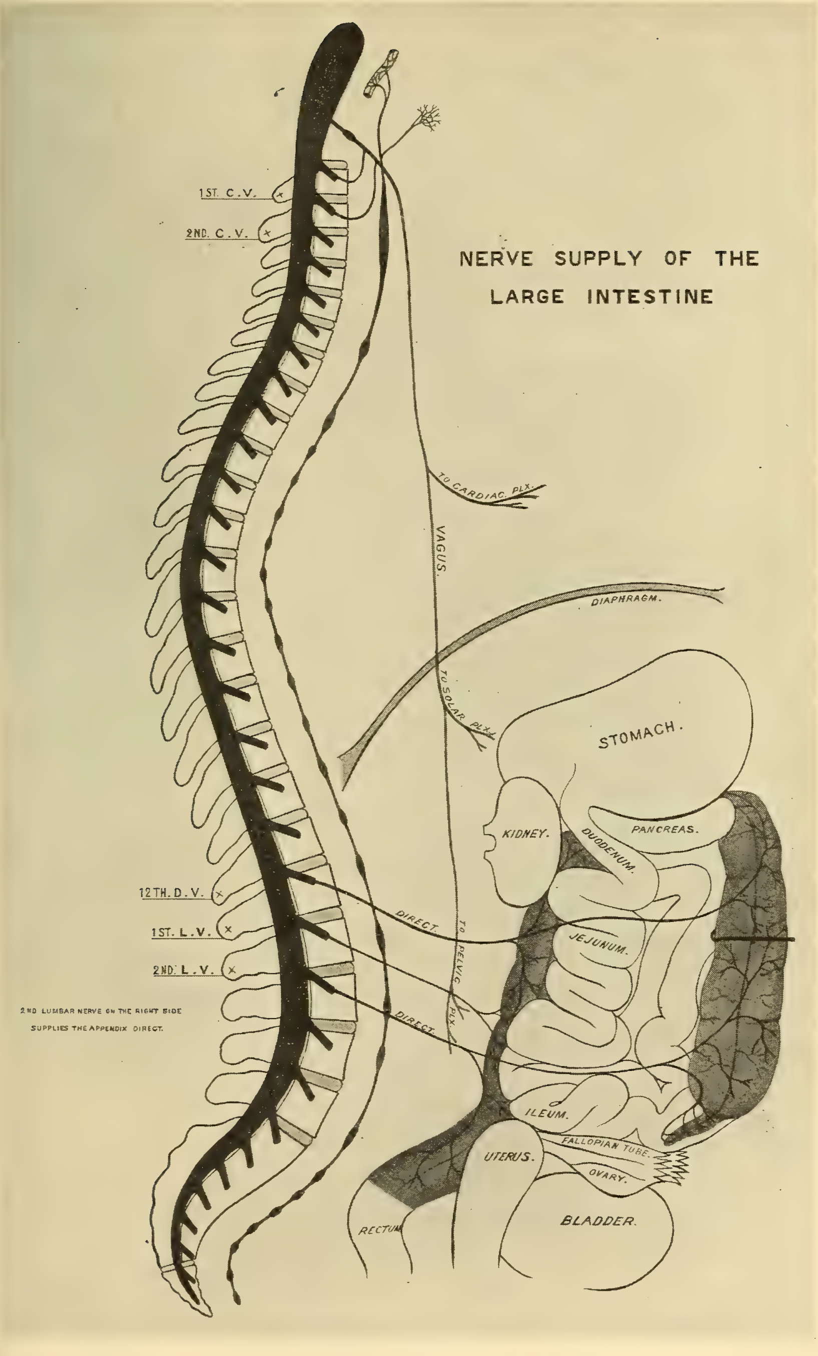
1. Pneumogastric.
2. Upper lumbar nerves.
3. Lower thoracic nerves.
4. Lower thoracic ganglia.
5. Great splanchnic nerves.
6. Least splanchnic nerves.
7. Lesser splanchnic nerves.

Spinal lesions involving the integrity of the nerve supply to intestines are as follows:

1. Upper cervical.
2. The upper lumbar.
3. The lower thoracic.

The following nerves influence the action of the colon:

1. Pneumogastric.
2. Great splanchnic.
3. Lesser splanchnic.
4. The least splanchnic.
5. Lower thoracic nerves.
6. Lower thoracic ganglia.
7. The upper lumbar nerves.



NERVE SUPPLY OF THE
LARGE INTESTINE
1ST. C.V.
2ND. C.V.
TO CARDIAC. PLX.
VAGUS.
DIAPHRAGM.
TO SOLAR PLX.
STOMACH.
KIDNEY.
PANCREAS.
DUODENUM.
12TH. D.V.
1ST. L.V.
2ND. L.V.
DIRECT.
TO PELVIC PLX.
JEJUNUM.
DIRECT.
2ND LUMBAR NERVE ON THE RIGHT SIDE
SUPPLIES THE APPENDIX DIRECT.
ILEUM.
FALLOPIAN TUBE.
UTERUS.
OVARY.
BLADDER.
RECTUM

The large intestine, or colon, is influenced most directly through the impulses of the second pair of lumbar nerves. Vasomotor and vasoconstrictor influences pass over the efferent fibers of the second lumbar to the large intestines.

Most cases of diarrhea and dysentery are directly influenced and controlled by a second lumbar adjustment.

The lower thoracic ganglia and spinal nerves influence the colon through the splanchnic nerves, and by means of the downward stream of white rami which join the hypogastric plexus.

The Appendix.—The nerve supply to the appendix would not be much different from that of the colon. We find that the second lumbar nerves are involved in all cases of appendicitis. The condition of the appendix depends, it seems, almost wholly upon the integrity of the second lumbar pair of nerves. In cases of appendicitis in the active or inflammatory stage, we will always find the second lumbar nerves tender on the right side, and sometimes we find that tenderness extends to the left side also.

We find by experience that by relieving the contraction of the musculature of this segment of the spine, that we produce an almost instant effect upon the appendix. Appendicitis is usually relieved, even in aggravated cases, in which there is much inflammation and derangement, in a few minutes' time, and recovery ensues very rapidly in ninety cases in a hundred. We fully believe that nine cases out of ten of appendicitis may be permanently relieved by a single thrust to remove interference with the second lumbar nerve on the right side.

Nerve Supply to the Peritoneum.—The nerve supply to the peritoneum is almost identical with the nerve supply to the large and small intestines, being directly supplied by the pneumogastric nerves from

above, and also in the upper portion by the phrenic nerves.

The peritoneum is also supplied by the great, lesser, and least splanchnics, and by white rami from the lower thoracic and upper lumbar spinal nerves.

The peritoneum is known to be able to take care of a considerable quantity of septic materials when it is the recipient of the normal physiological nerve impulses originating in the spinal cord and brain. A stimulation of the spinal centers will greatly enhance or increase this power of autoprotection of the peritoneum. If stimulation of the spinal centers were practiced in cases of peritonitis, this trouble would soon be considered but a trivial ailment, and easily conquered.

In all infectious diseases of the peritoneum, we reflexly get interference with the spinal nerve supply to the peritoneum. If we relieve that reflex contraction and stimulate the nerve centers to action, we would readily induce that efficient autoprotection that would prevent the development and spread of any infectious disease from one portion of the peritoneum to another.

Probably the most frequent involvement of the peritoneum is in the lower portion thereof, and the adjustment that will usually relieve peritonitis will be in the lower portion of the thoracic, down to and including the second lumbar segment of the spine.

CHAPTER IV.

NERVE SUPPLY TO PELVIC VISCERA.

THE nerve supply to the pelvic viscera is of sympathetic and cerebro-spinal origin. That part of the sympathetic system that contributes to the supply of the pelvic viscera is the hypogastric and inferior hypogastric plexuses, or what is sometimes termed the pelvic plexus. The spinal nerves which contribute to the supply of the pelvic viscera are:

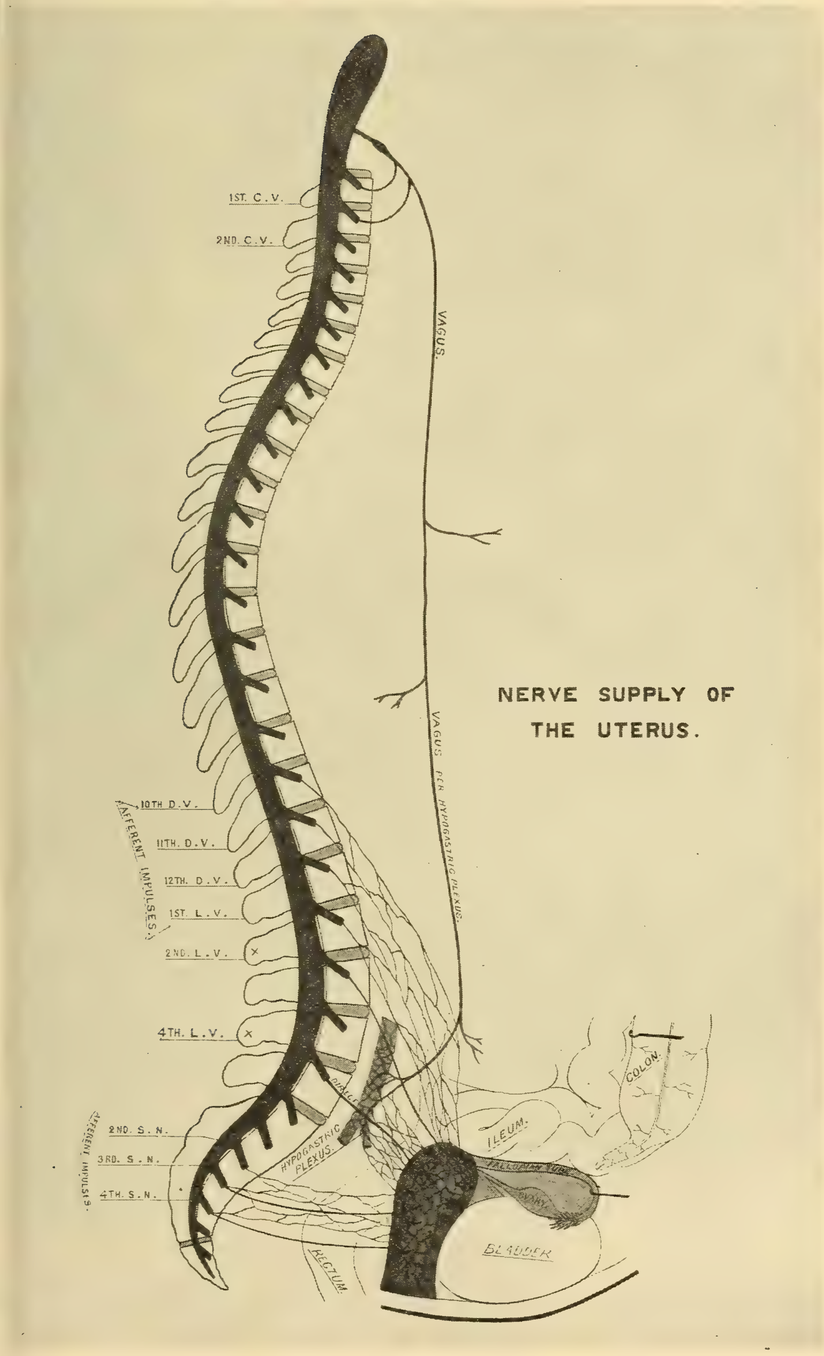
1. Pneumogastric.
2. Sacral nerves.
3. Lumbar nerves.
4. Lower thoracic.

In addition thereto, the first and second cervicals exert an influence upon the pelvic viscera because of their communicating branches to the pneumogastric nerves. The terminal branches of the pneumogastric join the hypogastric plexus and terminate in the pelvic plexus.

There are two peculiar features of the nerve supply to the pelvic viscera. One is that of the pneumogastric nerves because of their long continuation down through all of the viscera of the entire trunk, all of which they help supply or influence in a measure.

The other peculiar feature is, that the downward stream of white rami from the lower thoracic segments of the spine, join the gangliated cords of the sympathetic and pass down and enter into the formation of the pelvic plexus, and consequently into the supply of the pelvic viscera.

A portion of the nerve supply affecting the vitality and functioning of the pelvic viscera is peculiar in that, in the sacral region, the nerves are given off through



NERVE SUPPLY OF THE UTERUS.

solid bony foramina; consequently there is no chance for sacral nerves to become involved because of impingement produced by spinal contractions. However, any lesions affecting the integrity of the nourishment of the spinal cord in any of the regions above, will materially interfere with the integrity of the sacral nerve supply to the pelvic organs.

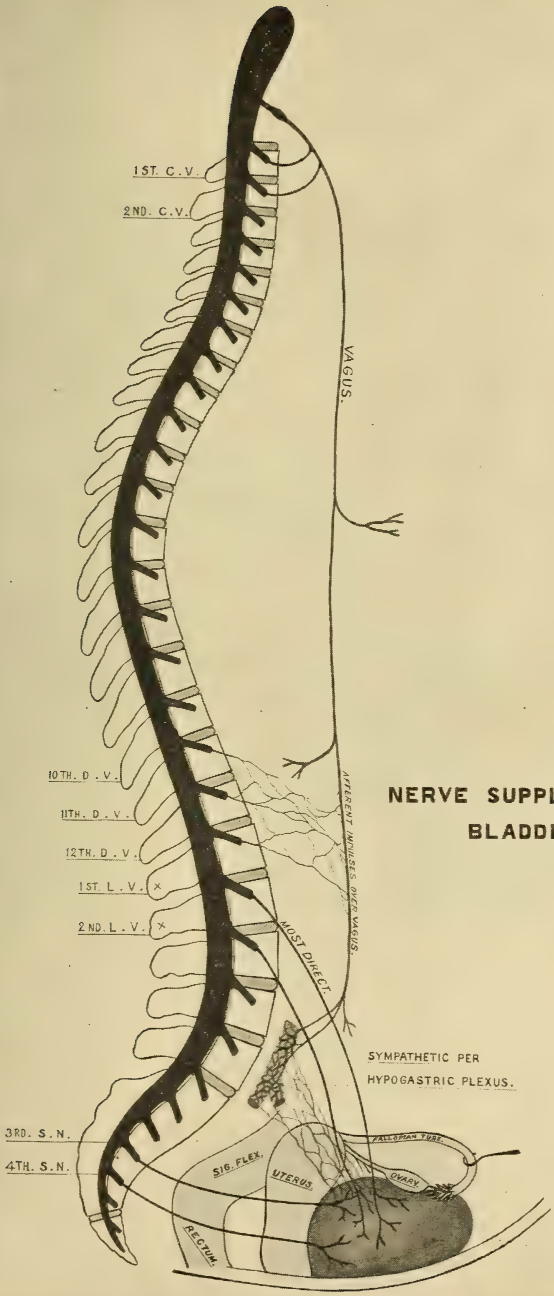
Nerve Supply to the Uterus.—The uterus is supplied principally by the uterine plexus, which is a terminal plexus of the sympathetic system, and also receives branches from the third and fourth sacral nerves. The hypogastric plexus and the vesical plexus also contribute to the uterine supply.

The uterine and hypogastric plexuses are materially influenced by the lower thoracic nerves, whose connection with these plexuses is by way of the downward stream of white rami communicantes, and these terminal ganglia are also materially affected by the lower lumbar, which communicates with them directly without passing into the gangliated cords of the sympathetic.

The principal vasomotor influences are excited by a stimulation of the fourth pair of lumbar nerves; however, there is some excitation of the hypogastric plexus by a stimulation of the first to the fourth lumbar nerves inclusive.

Adjustments to relieve the fourth lumbar nerves have a most decided effect upon the vascular system and muscular walls of the uterus. Lesions involving the integrity of the fourth lumbar are productive of malfunction, vasodilation, and prolapsus of the uterus and addenda.

Nerve Supply to the Bladder.—The nerve supply to the bladder is similar to the uterus, in that it receives its supply from both the sympathetic and cerebro-spinal nerves. It receives its sympathetic supply from the pelvic plexus of the sympathetic system, and receives its



NERVE SUPPLY OF THE BLADDER.

spinal nerve supply from the third and fourth sacral pairs of spinal nerves.

The bladder is especially affected by the lower thoracic and upper lumbar nerves, through the terminal plexus that supplies the bladder.

Stimulation of the tenth segment of the spinal column will cause an increase of the vasomotor and vasoconstrictor impulses to the bladder. An adjustment relieving any contractions or any interference with the first pair of lumbar nerves where they make their exit from the neural canal, has a very positive and curative effect upon cystitis. Some very stubborn, chronic cases of cystitis have recovered in a comparatively short time after the restoration of the integrity of the first pair of lumbar nerves, which was accomplished by an adjustment of the articulation between the first and second lumbar vertebræ.

We believe that in the majority of cases of cystitis, that this treatment will be very successful, and that an absolute cure without this measure in chronic cases, is almost, if not an impossibility.

We find almost uniformly that it is the first pair of lumbar nerves that has the most positive and decided influence upon the bladder.

Nerve Supply to the Prostates.—The prostate receives its nerve supply from both the sympathetic and cerebro-spinal division of the nervous system.

The hypogastric plexus of the sympathetic seems to supply most of the direct rami to the prostate glands.

The lower thoracic spinal nerves have a direct influence upon the hypogastric plexus, which supplies the prostate glands.

The sacral nerves also directly supply the prostate glands, but the lesions that most materially affect the prostate glands seem to be the third lumbar. In the treatment of prostatic troubles, then, we should remember

both the lower thoracic and lower lumbar nerves — more especially the latter.

Nerve Supply to the Ovaries and Testicles.—The ovaries are supplied by branches of the sympathetic, and by branches of the cerebro-spinal division of the nervous system.

The sympathetic supply for the ovaries and testicles is a plexus, which in the female is known as the ovarian plexus, an offspring of the renal plexus, and a continuation of the renal plexus along the ovarian artery.

The aortic plexus also gives off communicating rami which ramify the ovaries.

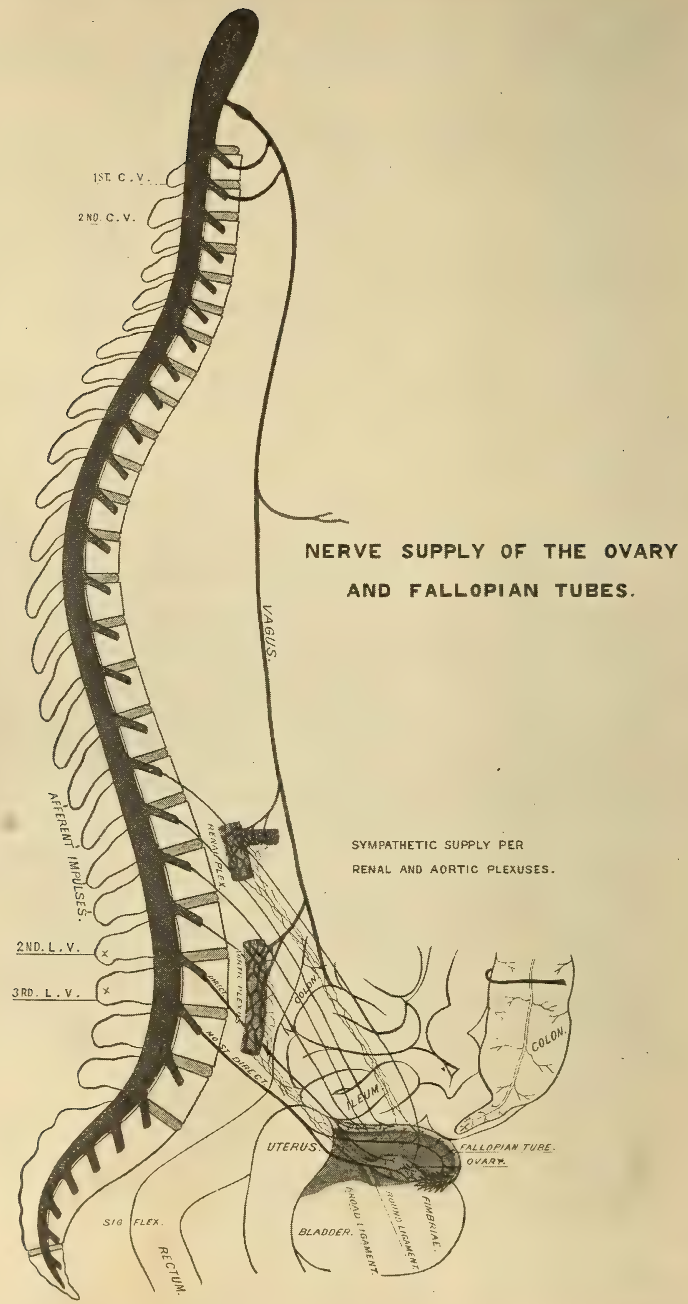
The spinal centers that affect the ovaries and testicles are situated at about the third lumbar segment of the spinal cord, while the nerves that have the most decided influence upon the ovaries and testicles come from the third lumbar pair of spinal nerves, which make their exit between the third and fourth lumbar vertebræ.

If there is no interference with the third pair of lumbar nerves, the chances are that the functioning of the ovaries and testicles will be normal unless branches supplying them more indirectly influence them adversely.

The sacral nerves contribute to the supply of these organs, as do the lower thoracic, which contribute the white rami communicantes to the downward stream that joins and supplies the terminal ganglia given off from the pelvic plexus.

Nerve Supply to the Inguinal Canal.—The nerves supplying the inguinal canals come off from the anterior crural nerves, which are made up of branches from the second, third and fourth lumbar nerves and branches from the lumbar plexuses.

In cases of interference with lumbar nerves, we are liable to have an atonic condition of the musculature of the inguinal canal. The relaxed condition induced thereby, associated with the relaxed condition of the



NERVE SUPPLY OF THE OVARY AND FALLOPIAN TUBES.

mesentery permitting a prolapse of the bowels, tends to permit hernia and protrusion.

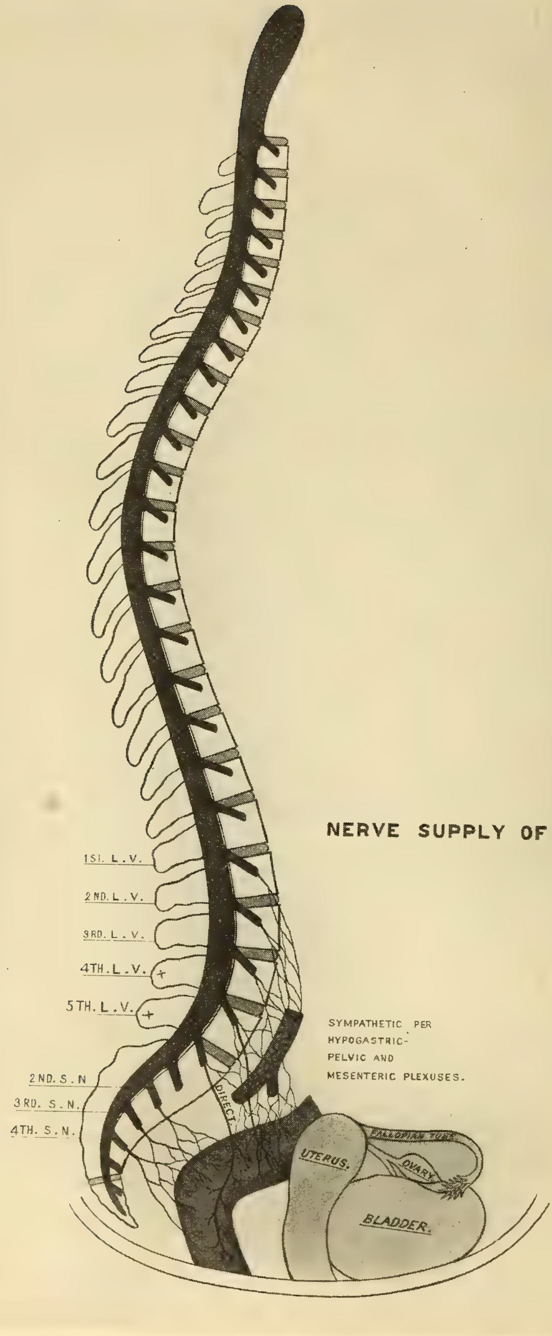
The removal of interference with the nerve supply is the best preventive, as well as the best relief for hernia. The second lumbar nerves seem to affect most materially the musculature of the inguinal canal, and for that reason we usually find an involvement of the second pair of lumbar spinal nerves in connection with all cases of hernia. Therefore, we usually excite and stimulate the second pair of lumbar nerves in cases of hernia and often the results are indeed surprising.

Percussion in the region of the eleventh and twelfth dorsal segments of the spinal column will stimulate the nerve supply to the inguinal canal. Cases of hernia of long standing often respond readily to a stimulation of the second pair of lumbar nerves by percussion over the roots of the efferent fibers, and also these cases have been relieved by relieving all interference with and by restoring the integrity of the second pair of lumbar nerves.

Nerve Supply to Rectum.—The nerve supply to the rectum is from the sympathetic, and also from the cerebro-spinal division of the nervous system.

Branches are given to the rectum from the mesenteric plexus, from the sacral plexus, and from the hypogastric plexus. The spinal nerves to the rectum come directly from the third, fourth, and fifth sacral nerves, which supply motor and sensor roots, but the spinal nerves that affect the rectum, and that may become impinged because of contractions affecting the foramina between movable vertebræ, originate about the fourth or fifth lumbar segments of the spinal column, so that stimulation by percussion over the twelfth dorsal vertebræ has a vasomotor and stimulating effect upon the nerve supply to the rectum.

A thrust given to the spinous process of the fourth and fifth, and more especially the fifth vertebra, will



NERVE SUPPLY OF THE RECTUM.

relieve the principal spinal nerve supply, affecting the rectum. This nerve supply, though, is not direct, but the result of white rami from the fourth and fifth—more especially the fifth pair of lumbar nerves, which join the terminal ganglia of the pelvic plexus which supply the rectum.

By some it is claimed that the centers of micturition, defecation, and parturition, are contained within the second lumbar segment of the spinal cord.

Nerve Supply to the Genitalia.—The nerve supply to the genital organs is from both the sympathetic and cerebro-spinal system, and is supplied by the sympathetic from the pelvic plexus and the terminal ganglia given off therefrom, and the spinal nerve supply is from the lower thoracic, lumbar, and sacral regions.

The lower thoracic contribute influences to all the pelvic organs, including the genital organs, by means of the downward stream of white rami communicantes. The more direct spinal nerve supply is from the lumbar and sacral regions.

As sacral nerves cannot be interfered with, we find the principal effect that we produce upon the genital organs, as well as all other pelvic organs, is by stimulation or adjustment to relieve interference with the lumbar nerves.

The second pair of lumbar nerves excite a vasomotor and stimulating effect upon the erectile tissues of the genitalia. The third and fourth lumbar nerves also have a direct and positive effect, and it is claimed that relief of the fourth pair of nerves will relieve the nerves that come from the genital centers of the spinal cord.

CHAPTER V.

CEREBRO-SPINAL CENTERS.

THERE are certain parts or centers in the brain, and certain segments in the spinal cord, that seem to be a dividing point, or a center, so to speak, because of the anatomical arrangement of the nerves originating therefrom or because of the divergence of the nerves in their ramifications.

We will only refer, in this connection, to those spinal centers that are most clearly marked, or the more prominent and manifest centers of the spine, and will also mention those special initials or names that are recognized as applying to certain segments of the spinal column, or to certain vertebræ thereof, and will also state briefly why they are so denominated.

In the brain there is no decidedly distinct center or division existing, yet we find in the ramification of the twelve pair of cranial nerves a slight demarcation or difference existing in the distribution of the first eight and the last four. The first eight of the twelve pair of cranial nerves are distributed directly and wholly to the organs of the head and face, as follows:

First pair to the Schneiderian membrane of the nose.
Second pair to the retina of the eye.
Third pair to the muscles of the eye.
Fourth pair to one muscle of the eye.
Fifth pair to the teeth, tongue, and face.
Sixth pair to the superior oblique of eye.
Seventh pair to the ear, palate, tongue, face.
Eighth pair to the internal ear, acoustic nerves.

None of the above seem to ramify any portion of the cervical region, except a few nerve fibers from the fifth and seventh facial nerves, consequently the first

eight pair are peculiar in this, that they are distributed almost entirely to the head, or different parts of the organs of the head and face.

Now, passing from the first eight pair of the cranial nerves, we come to cranial nerves that ramify regions outside of the head; in fact, in some cases going into the lower portion of the trunk. The glosso-pharyngeal nerves do not extend very low, but they ramify portions of the cervical region and send branches to the tonsils, but the tenth is entirely different, in that its ramifications are almost wholly downward through the cavities of the trunk extending into the pelvic region.

The spinal accessory pair of cranial nerves, and also the twelfth pair, ramify portions of the neck, and thus classify with the ones above, and differentiate in this matter from the first eight. This makes a minor dividing line, then, between the first eight pair and the last four pair of cranial nerves, but it is not of great importance in treatment, but more of a marked anatomical feature.

In the cervical region we have eight pair of spinal nerves. We have also in the cervical region a clear point of demarcation because of the difference of the ramification of the lower cervical and the upper cervical pairs of nerves. The upper four pair of cervical nerves, by a union of their primary anterior branches, enter into the formation of the cervical plexus, and the branches of the cervical plexus are distributed largely to the upper cervical regions of the neck and the side of the face and scalp.

The lower four pair of nerves of the cervical region unite in the formation of the brachial plexus, and their branches of distribution tend to pass downward over the chest and outward into the upper extremities. We have branches from the brachial plexus that supply the front and back portions of the chest, and branches that run as far down on the side of the chest as the lower side of the

serratus magnus muscle, or to the lower border of the ninth ribs.

The other branches of the brachial plexus, however, pass into the upper extremities. This peculiarity of the arrangement of distribution of the lower four cervical nerves, makes a decided difference and a distinct dividing line between the lower four and the upper four cervical nerves.

There is, however, one important or apparent deviation of this division of the upper and lower cervical nerves in that the fourth pair seem to affect decidedly the teeth, the gums, and the pupils of the eyes. They give off the phrenic nerves, which pass down to and supply the pleuras, pericardium, and diaphragm, and also send branches of ramification and supply viscera down as far as the supra-renal capsules of the kidneys.

The line of demarcation which is manifest between the distribution of the upper four and the lower four cervical pairs of nerves, is of some importance in diagnosis, or in locating the spinal lesions affecting the chest and upper extremities, and also those lesions which affect the head and cranial organs.

The connection of the upper cervical nerves with the terminal ganglia of the sympathetic, and the fact that they are distributed almost wholly to these ganglia, shed much light on the way in which we affect the organs of the head by upper cervical adjustment, and how, by relieving interference with upper cervical nerves, we will restore normal function to different organs of the head region. It is remarkable the effect we may have upon the hearing, sight, teeth, gums, nasal cavity, scalp, and face, by removing all interference with the spinal nerve supply to them.

In the thoracic region we have a clearly marked center that is very important from the standpoint of both diagnosis and treatment, and also from the anatomical

differences in the arrangement, distribution, and ramification of the rami communicantes.

Let us recall for a moment that the spinal column is the first portion of the nervous system that is formed in embryonic development. Second, the brain is really a growth on to the upper end of the spinal cord, and the lower nerves to the lower extremities are a continuation of the extension of the spinal nerves downward. Also, in the development of the fetus, the viscera of the trunk are first assembled, or begin to be developed in the central region of the future trunk, and as the fetus reaches a more perfect development, these organs tend to move toward their permanent location which they occupy in the fully developed child. Now, the central point from which all viscera gravitate in the trunk, becomes at once a most important center.

Now the question is, where is this center located? What is central place in the thoracic cavity? There are a number of anatomical facts that furnish us a key to the location, and there are differences in the distribution of nerves that mark the location of central place, and mark central place so clearly that we cannot make a mistake, unless we are unconscious of the points of demarcation.

The first thing that marks the location of central place in the thoracic region, to which we call your attention, is the point of the division between the two streams of the white rami communicantes which join the gangliated cords of the sympathetic division of the nervous system. Down to, and including the fifth pair of spinal nerves, and some fibers from the sixth, we have white rami communicantes that join the gangliated cords of the sympathetic, and the tendency of these white rami after doing so, is to form an upward stream by sending some of their fibers upward.

Not all of these fibers, however, pass up as noted in

a previous chapter, as some of the white rami fibers pass directly through the ganglia where they join in the gangliated cord to the terminal ganglia, while other fibers arborize around the ganglionic cells in that portion of the cords, where they join them.

Another division of the white rami pass via the commissural portion of the gangliated cords up to, and terminate in the superior cervical ganglia of the sympathetic.

Now we have from the lower six thoracic nerves, white rami communicantes, which join the gangliated cords of the sympathetic, forming a downward stream of white rami communicantes. These behave somewhat similar to the white rami forming the upward stream, in that all the fibers do not pass downward, but only a portion of them. This marks clearly and unmistakably the location of central place at the sixth segment of the spinal cord, or at the point of exit of the sixth pair of nerves of the thoracic region.

Another indication of the division that exists, is the plan of the formation of the cardiac and solar plexus. The upper five pair of thoracic nerves, and branches from the sixth pair of thoracic nerves, enter into the formation of the cardiac plexus, while from the sixth down to, and including the twelfth, the white rami communicantes passing through the gangliated cords, join in the formation of the epigastric or solar plexus. This point also marks clearly and unmistakably the location of central place at the sixth thoracic segment, or at the sixth pair of thoracic nerves.

Peripheral markings of the division existing between the upper and lower thoracic nerves, which markings also show that central place is at the sixth segment, are as clear, pointed, and unmistakable as are the internal variations.

The upper six pair of thoracic nerves supply, and are wholly distributed to the walls of the thoracic cavity,

while the lower six are distributed partly to intercostal spaces, and partly to the walls of the abdominal cavity.

Again, the internal branches of the upper six intercostal nerves are distributed to the skin, while their external branches are distributed to the muscles. In the lower thoracic region, we have the reverse of this arrangement, in that we have the external branches of the intercostal nerves supplying the skin, while the internal branches are distributed to the muscles.

There is still another anatomical difference or line of demarcation between the upper and lower six intercostal nerves in the location of their branches, as follows: The upper six intercostal nerve branches are located, or pass between the pleura and the intercostal muscles, while the lower six are situated between the skin and the abdominal muscles.

The above difference marks the anatomical location of central place clearly and distinctly, and the sixth dorsal segment is the only place at which we may locate central place, as it is the location of the dividing point between the anatomical features that we have just mentioned.

This is one of the most important centers of the nervous system. It is not only important from the standpoint of diagnosis and the standpoint of treatment by adjustment, but is especially important from the standpoint of treatment in case we wish to stimulate the motor centers affecting the organ of the cavity of the trunk, as the arrangement each way from the central place is reversed with reference to the location of the vasodilator and vasoconstrictor centers.

In the lower part of the thoracic nerves, we have a subcenter, so to speak, but it is also quite an important center. We notice by stimulation of the spinal nerves that we will induce perspiration, and further we notice this peculiarity, that, when we make an adjustment above

the tenth thoracic, the perspiration is stimulated from that segment of the adjustment upward. Below the tenth we find stimulation of the spinal nerves affect the activity of the skin below point of thrust.

The dividing point between these differences in skin action, is at the tenth thoracic segment of the spinal column. A stimulation of the tenth segment increases or influences the action of the skin of the entire body. We find this fact laid down by some of our physiologists and find that the writers thereof have located the central place for skin action at the tenth thoracic. This is an important point, and one that should be remembered in the treatment of all skin troubles.

If we wish to increase the action of the elimination of both the skin and the kidneys, an adjustment of the tenth thoracic for the stimulation of this pair of nerves will prove effective in most cases.

Percussion over the sixth or seventh cervical vertebræ would stimulate to a still greater action the centers that give rise to the nerves that we influence by an adjustment of the tenth thoracic.

Now, of the above centers we have mentioned, they are all important, save the one division mentioned, of the cranial nerves.

From the fourth cervical nerve we have such a direct action upon the circulation of the thoracic cavity upon the organs of the head; and from the sixth we have a decided action upon the entire central nervous system. I have been enabled to stop some cases of chorea and St. Vitus dance by a single thrust, because of the influence of the sixth pair of thoracic nerves upon the central nervous system.

CHAPTER VI.

CEREBRO-SPINAL CENTERS.

FOR convenience and for brevity and because of an established custom among certain practitioners of spinal adjustment, we will outline an initial nomenclature used to indicate the different spinal vertebræ or vertebral processes.

There is an air of professional competency denoted by the use of such a system of identification which is somewhat superior to calling spinal vertebræ by number.

We cannot fully agree with the nomenclature that has formerly been used by some educators in this line of work, and for this reason we have made some significant changes, but only where it seemed that such a change was urgently demanded by the anatomical facts in the case.

We hope that some uniform initials of identification may be agreed upon and adopted by all the teachers and practitioners of spinal adjustment methods.

We will now enumerate the initials that are usually applied to the different vertebræ of the spinal column, as used by those who practice spinal adjustment or chiropractic spondylotherapy, as far as we can endorse the nomenclature that has been applied:

At. P. Atlas Place.—The first cervical pair of nerves as they are relieved by atlas adjustment, have been denominated atlas place.

C. C. P. Central Cervical Place.—The fourth pair of cervical nerves are considered the dividing point, or central place, of the cervical nerves. This is because of the peculiarity of the ramification in which this fourth pair of nerves are distributed—partly upward similar to the upper four cervical nerves, and other fibers downward

similar to the lower four cervical nerves. It is therefore called the central cervical place.

L. C. P. Lower Cervical Place.—The lower cervical nerves embracing those from the fifth, down to and including the eighth, are called the lower cervical places.

A. P. Arm Place.—Owing to the fact that the first thoracic nerves give off very large anterior primary branches of ramification that go into the formation of the brachial plexuses in connection with the lower cervical nerves, and as they have so much to do with the general nerve supply of the arms, the first thoracic vertebra has been denominated arm place.

The first pair of thoracic nerves in their ramification, are different from the other upper thoracic nerves, in that the anterior branches containing most of the fibers of these nerves pass into the brachial plexuses, while the intercostal nerves are very small branches of the first pair of thoracic nerves.

The second pair of thoracic nerves are divided in the same way, but there is a less amount of their fibers that go into the formation of the brachial plexuses. They, however, give off the intercosto-humeral nerves, which join with the brachial plexuses and send branches into the arms. We often relieve pain and functional derangement of the upper extremities by adjustment of the second thoracic vertebra.

U. H. P. Upper Heart Place.—The second thoracic pair of nerves, or second thoracic segment of the spinal column, has been called upper heart place, for the reason that it has a more important effect and a more decided influence than any pair of nerves above this region.

A stimulation of the second pair of thoracic nerves may produce a very decided vasomotor stimulation and vasoconstriction action affecting the heart. We relieve interference with the vasoconstrictor influences by having

the second pair of thoracic nerves made free from interference. If we wish to intensify the vasomotor and vasoconstrictor influences upon the heart, we may do so by stimulating the roots of origin of the second pair of thoracic nerves. This may be done by percussion over the spinous or transverse processes of the seventh cervical vertebra. This is a very important auxiliary treatment in case of thoracic or abdominal aneurism or in case of dilatation of the heart or general vasodilation.

The second pair of thoracic nerves also have a very important influence upon the bronchial tubes, and relief of interference with these nerves is a specific for bronchial coughs, which is due to the extensive ramification of the bronchial tubes by the second pair of thoracic nerves.

Lg. P. Lung Place.—The third pair of thoracic nerves have been denominated lung place, because of the fact that they ramify the upper part of the chest, and give the principal supply to the pleura of the lungs and also to the apexes thereof; all of the upper portion of the lungs is ramified and principally supplied by the third pair of thoracic nerves.

It seems that the reason why the third pair of thoracic nerves have so much to do with the supply of the pleura and the lungs, is because of their origin being in close proximity to the roots of the lungs, and to that portion of the pleura which receives the principal nerve supply. We know by experience that these nerves ramify the pleuras to their lowest extremities. We have been able to relieve pleurisy in almost every case by relieving the third pair of thoracic nerves.

The writer calls to mind a case of pleurisy that had been diagnosed as gall stones. The case was sent from Indiana to Oklahoma, hoping that the change of water and climate might give some relief from the constant suffering from the passage of gall stones. Climatic influences, however, had but little or no effect upon

this case, and subsequently the patient contemplated undergoing an operation for the removal of gall stones.

Before the operation was performed, and while arrangements were being made, a friend of the lady brought her to the writer for an examination. Upon examination, we found no trouble with the nerve supply to the liver, and said without a doubt and without hesitancy that there was no trouble with the gall bladder, and no gall stones. Further examination elicited the fact that the third thoracic nerve on the right side was very tender and sensitive, whereupon a diagnosis of pleurisy was made.

An inquiry into the history of the case substantiated the indications of the spinal lesions. Treatment was given, which consisted of a thrust to the third thoracic spinous process, and absolute relief was given. One week's treatment was sufficient to overcome all of the symptoms, and no subsequent attack has returned. This case had suffered with pleurisy for five years since an attack of pneumonia. A general vasoconstrictor influence may be obtained by percussion over the spinous processes of the fourth and fifth cervical vertebræ, while vasodilation is produced by percussion over the spinous processes of the fifth to the eighth thoracic vertebræ. Percussion over the spinous process of the seventh cervical vertebra will cause vasomotor stimulation of the lungs.

H. P. Heart Place.—The fourth thoracic pair of spinal nerves which are given off from the fourth spinal segment of the spinal cord, is known as heart place.

This is due to the fact that the fourth pair of thoracic nerves affect very materially the muscular walls of the heart, and induce an inhibitory control of the heart's action, as well as stimulating the vasomotor and myomotor action of the heart.

We find that by removing interference with the fourth

pair of nerves, that we have a very decided effect upon the heart. Persons who have ceased to breathe and whose hearts have ceased to beat during anæsthesia from chloroform, have been brought back to life by a thrust relieving and stimulating the fourth pair of thoracic nerves.

Percussion over the first and second thoracic spinous processes will have a similar inhibitory effect upon the heart's action. This is because of the fact that the fourth segment of the spinal column is more nearly directly within the neural canal under the first and second thoracic vertebræ. Now, for the above reason, in case of heart failure, we may intensify the effect of our treatment by a thrust to relieve interference with the fourth pair of thoracic nerves, followed by percussion over the seventh cervical, or over the first and second thoracic spinous processes.

S. P. Stomach Place.—The fifth thoracic spinous process or vertebra has been called stomach place, not because the fifth pair of thoracic nerves are the only ones that enter into the nerve supply of the stomach, but because usually the nerves from the left side of the spine, from this segment, seem to influence and most decidedly stimulate the action of the stomach.

The left nerves from the fifth thoracic segment pass into the superior and cardiac end of the stomach; hence have most to do with the functioning of that organ. The sixth, seventh, and even the eighth pair, also contribute to the nerve supply that influence the stomach, but as we go below central place and stimulate nerve centers, we begin to have a vasodilator influence upon the stomach instead of a vasoconstrictor, as we do through the fifth pair of nerves.

The stomach is situated within the upper part of the abdominal cavity, and is consequently supplied by the solar plexus. There is one peculiarity concerning the nerve supply to the stomach and that is the fifth

thoracic nerve on the left side has so much to do with the nerve supply to the stomach. The fifth thoracic nerves on the right side send their branches upward to the throat and organs of the head, on the left side, into the cardiac or thoracic cavity. Vasomotor stimulation of the stomach may be produced by percussion over the spinous process of the second thoracic vertebra.

C. P. CENTRAL PLACE.—This is one of the most important segments of the entire spinal column, and has the most decided and positive effect upon the general nervous system. This pair of nerves not only supply the organs adjacent to their ramification, but the organs of the entire body are influenced by the general effect upon the nervous system through stimulation of the sixth segment of the spinal cord, or by freeing the sixth pair of thoracic nerves.

The most direct influence upon the spleen is also through the sixth pair of thoracic nerves, and also the sixth pair often have a most positive influence upon the stomach. The most positive stimulating effect upon the central nervous system may be obtained by percussion over the spinous processes of the second and third thoracic vertebræ.

L. P. LIVER PLACE.—The seventh pair of thoracic nerves and the seventh segment of the spinal cord have been called liver place, because of the fact that the seventh pair of nerves enter more fully into the supply of the liver than any other pair, and influence the liver in fact more than any other.

The liver is a large organ, however, and receives branches from several different pairs of spinal nerves; but being located entirely on the right side it is only supplied from the right side of the neural canal. The sixth, seventh, and eighth furnish the principal supply to the liver. Percussion of the segment of the spine under the tip of the spinous process of the fourth thoracic

vertebræ will cause stimulation of the nerve supply to the liver.

P. P. PANCREATIC PLACE.—The eighth thoracic segment may be called pancreatic place for this reason: From the eighth pair of thoracic nerves on the left side, and from the sixth pair of thoracic nerves, is formed a plexus that seems to almost wholly supply both the spleen and pancreas.

The spleen is above, and is influenced more by the sixth pair of nerves, while the pancreas is below, and influenced more by the eighth pair of spinal nerves; hence we denominate the eighth pair of spinal nerves as pancreatic place, notwithstanding that they have a material influence upon the upper portion of the small intestines. Percussion to stimulate the segments of the cord from which originate these nerves will cause dilation of the lungs because of the connection and influence of these nerves upon the terminal ganglia of the phrenic nerves.

Ad. P. ADRENAL PLACE.—The ninth thoracic pair of spinal nerves supply the supra-renal capsules of the kidneys, and for this reason may be called upper kidney place, or adrenal place, and we have chosen the latter nomenclature.

K. P. KIDNEY PLACE.—The tenth thoracic vertebra is called kidney place, for the reason that the tenth pair of nerves seem to have the most direct and positive influence upon the kidney action.

In addition to the branches given off from the tenth pair of spinal nerves, we have the renal plexuses, which are formed from the twelfth thoracic pair of nerves, so the tenth thoracic pair of nerves are not by any means the only nerves influencing the kidneys.

U. B. P. UPPER BOWEL PLACE.—The eleventh thoracic we denominate upper bowel place, for the reason that the eleventh pair of thoracic nerves materially

influence the small intestines as well as the kidneys. This is also true of the twelfth pair of thoracic nerves. Both the eleventh and twelfth thoracic segments may be denominated bowel place. They both enter into the formation of the solar plexus, and both have to do with the direct nerve supply to the major portion of the small intestines.

L. K. P. LOWER KIDNEY PLACE.—The twelfth thoracic vertebra and the twelfth thoracic pair of nerves we denominate the lower kidney place, because of their influence upon the kidneys, for the reason that from this pair of nerves are given off branches forming the renal plexus. The twelfth pair of thoracic nerves also affect the bladder. This seems to be because of the downward stream of the white communicantes.

B. P. BLADDER PLACE. (First lumbar vertebra.)—There is no pair of spinal nerves that seems to have a more positive stimulation and vasomotor effect upon the bladder than the first lumbar pair, and there are no nerves that are so uniformly responsible for the functions of the bladder as are the first lumbar pair of nerves.

L. B. P. LOWER BOWEL PLACE.—The second lumbar vertebra, so called because of the decided influence of the second pair of lumbar nerves upon the large intestines. The second lumbar nerves are very important for the reason that they supply the appendix and inguinal canal, influencing the large and small intestines, but have been called genital place because of the vasomotor effect upon the erectile tissues of the genital organs.

O. P. or T. P. OVARIAN OR TESTICLE PLACE.—The third pair of lumbar nerves are so called because of their direct influence upon the ovaries of the female, and they also supply the testicles of the male.

L. G. P. LOWER GENITAL PLACE.—The fourth lumbar pair of spinal nerves are so called because they are derived from that segment of the spinal cord containing

the genital centers, and further, because of their direct influence upon the uterus, especially vasomotor effects upon this organ.

The fourth pair of nerves also influence and help to supply the rectum.

R. P. Rectal Place.—The fifth pair of lumbar nerves are supplied most directly to the rectum, and it is this pair of nerves that may become involved because of spinal lesions. For this reason, the fifth lumbar vertebra has been denominated rectal place.

Now in the above we have enumerated, as far as we could, the initials that are commonly used by practitioners of chiropractic spondylotherapy, and are only sorry that we could not conform to their nomenclature throughout, but we fully believe that the above nomenclature is more correct.

Again, we should remember in all spondylotherapy methods, that in treating the centers above, or relieving the nerves above mentioned, that we are only relieving the principal nerve supply to the organ or the viscus in question, as all of these organs receive a nerve supply, or are influenced by the ramification of nerves from different segments of the spinal column.

For your convenience, we enumerate below the names and initials that have been indicated above, as follows:

1st Cervical	A. P.	Atlas Place
2d Cervical	Ax. P.	Axis Place
3rd Cervical	U. C. C. P.	Upper Central Cervical Place
4th Cervical	C. C. P.	Central Cervical Place
5th Cervical	L. C. C. P.	Lower Central Cervical Place
6th Cervical	L. C. P.	Lower Cervical Place

7th Cervical	U. A. P.	Upper Arm Place
1st Thoracic	A. P.	Arm Place
2d Thoracic	U. H. P.	Upper Heart Place
3rd Thoracic	Lg. P.	Lung Place
4th Thoracic	H. P.	Heart Place
5th Thoracic	S. P.	Stomach Place
6th Thoracic	C. P.	Central Place
7th Thoracic	L. P.	Liver Place
8th Thoracic	P. P.	Pancreatic Place
9th Thoracic	Ad. P.	Adrenal Place
10th Thoracic	K. P.	Kidney Place
11th Thoracic	U. B. P.	Upper Bowel Place
12th Thoracic	L. K. P.	Lower Kidney Place
1st Lumbar	B. P.	Bladder Place
2d Lumbar	L. B. P.	Lower Bowel Place
3rd Lumbar	O. P.	Ovarian Place
4th Lumbar	G. P.	Genital Place
5th Lumbar	R. P.	Rectal Place

CHAPTER VII.

SPINAL CENTERS.

IN this chapter, we wish to consider briefly the different segments of the spinal column from the standpoint of their influence upon the different viscera of the body when stimulated by spinal concussion for therapeutic purposes.

Now in our study of the function of nerves, we find that they have a myomotor influence that affects the musculature of the entire body.

We find, by a study of the vasomotor influence of the nervous system upon the musculature system, that the vasomotor nerves exert both a vasodilator and a vasoconstrictor influence upon the heart and vascular system.

Nerve action of any kind may be increased by stimulation, and one of our best and most effective methods of nerve stimulation is that of concussion, if properly applied over the different segments of the spinal cord.

We may increase the myomotor action of any portion of the body or any viscera contained therein by concussion and stimulation of the special spinal centers from which originate the nerve supplying the zone or part we desire to affect.

We may affect vasoconstriction in case of congestion, aneurism or dilation of the heart, but, in order to do so, we should understand and use the best and most effective methods of stimulation and also the conditions under which such treatment should be given.

The efferent nerves may be best and most powerfully stimulated by the application of the stimulant to their central ends of origin in the spinal cord or brain. The efferent nerves are especially prepared, as to excitability, for the reception of impulse at their central origin.

It is true that an efferent nerve may be stimulated at its point of exit from the neural canal or at any point of its pathway of distribution, but stimulation of an efferent nerve at its central origin where it is prepared for the reception of impulse, produces the maximum result in the increase of impulse generation and transmission, and also the maximum amount of work done by the nerve so stimulated, provided it is not hindered in its power of conductivity by impingement.

The conductivity of a nerve is liable to be depreciated by an interference with that nerve at its point of exit from the neural canal either by impingement or by the occlusion of the nutrient supply.

A nerve that is stimulated at its central origin may fail to induce normal functional activity in any organ or part of the body because of structural lesions of the zone supplied, or because of retention of the by-products of muscular activity or of imperfect digestion and deposits of uric acid and urates into the cellular structures.

For the above reasons it is necessary that we have perfect freedom of efferent nerves from any interference of any nature in their power of production and transmission of impulse, and it is necessary that the histological or structural condition of the zones supplied by the nerves stimulated be in a normal condition that normal function may be produced.

If a nerve center is interfered with so that it lacks the power of excitability and initiation of impulse or the nerve is impinged so that the power of conductivity is diminished, it is necessary to remove such interference that we may experience the full result of the stimulation which we induce by concussion or by other methods of stimulation. It is also necessary to assist in many cases the dissolution and elimination of the effects and by-product matters accumulated as the result of retention.

In this chapter we wish to call attention to the

influence of nerves upon the organs they supply and affect. We wish to call special attention to the effects of concussion of certain vertebræ or segments of the spine, upon certain internal organs or parts of the body. We will of necessity be brief and will especially call attention to those who are interested in this excellent auxiliary method of spondylotherapy to the book Spondylotherapy by Dr. Albert Abrams which is devoted especially to this subject.

Upper Cervical Nerves.—These nerves supply communicating branches to the terminal ganglia of the upper cervical and cranial regions. First by adjustment of this region we remove all interference with the upper cervical nerves, and by so doing we restore their normal conductivity, and a free transmission of the normal physiological impulses, which are or should be transmitted by them. In this way we relieve pain in the parts they supply and affect, causing toothache, earache, tic douloureux, etc.

Now if we wish to increase the amount of impulse which is transmitted to above the normal we may do so by concussion applied to either the spinous or over the transverse processes of a vertebra. Concussion over the upper two cervical vertebræ affects the brain and almost every organ in the cavities of the trunk. It is best to apply the concussion to the laminæ of the cervical vertebræ. By concussion of the atlas and axis we affect the recurrent meningeal nerves which are formed partly by branches of the first and second cervical pair of nerves. We also stimulate the pneumogastric through stimulation of the first and second cervical nerves which send communicating branches into the pneumogastric nerves.

From the above we see how we may stimulate the brain and also the heart, lungs, and stomach, by affecting the recurrent meningeal and pneumogastric nerves.

Stimulation of the upper cervical nerves will produce a decided effect upon the eyes, ears, and the brain.

MIDDLE CERVICAL NERVES.—Concussion over the origin of the fourth and fifth cervical nerves will exert a special stimulating effect upon the phrenic nerves. Concussion over the third cervical accelerates the action of the heart. Concussion over the fourth and fifth cervical also excites the myomotor action of the heart and a vasoconstrictor influence upon the lungs. Concussion in the middle cervical region will resuscitate a patient in case of sudden heart failure and is a useful measure in cases of fainting. Adjustment or concussion affecting the first and second cervical nerves is also a useful method in resuscitation because of the influence of the communicating branches of these nerves upon the pneumogastric.

LOWER CERVICAL VERTEBRÆ.—In concussion of the lower cervical segments we affect the upper thoracic nerves for the reason that the centers of origin of the upper thoracic nerves are situated in the spinal segments which are in the neural arches of the lower cervical vertebræ.

Concussion over the spinous or transverse process of the seventh cervical vertebra stimulates the origin of the second pair of thoracic nerves. The center of origin of this pair of nerves is one of our most important spinal centers because of the general effect exercised upon the vasomotor system. Concussion over the seventh cervical vertebra causes myomotor action of the heart muscles. Vasomotor and vasoconstrictor effects upon the heart aorta and blood vessels generally. Seventh cervical concussion is especially recommended for aneurism, dilation of the blood vessels in goiter or in congestion of the eyes, ears, or viscera, or thoracic or abdominal cavity because of the vasomotor and vasoconstrictor action that is thus induced.

Concussion over the seventh cervical vertebra will also restore to life in cases of recent heart failure, and this method has long been used by the Japanese.

Concussion over the first and second thoracic vertebræ especially stimulates the fourth pair of thoracic nerves. They furnish myomotor and vasoconstrictor action of the heart muscles and exert an inhibitory influence upon the heart's action.

Patients who have suddenly become unconscious and in whom the heart has ceased to beat, from chloroform or sudden heart failure, may have the heart's action restored by a fourth thoracic adjustment, which will relieve and stimulate the fourth pair of thoracic nerves or they may be restored by concussion over the first and second thoracic. When a person is restored by or through stimulation of the fourth pair of thoracic nerves the heart's action will be strong and full but slow, seldom above normal because of the inhibitory influence of this pair of nerves.

Concussion of the first and second thoracic vertebræ then will strengthen and inhibit the heart's action by affecting the fourth pair of thoracic nerves.

Third to Eighth Dorsal.—The third to eighth dorsal vertebræ contain in their neural arches the centers of origin of all the thoracic nerves from the fifth or sixth down to and including the twelfth pair of thoracic nerves. The fifth to the twelfth pair of thoracic nerves enter into the formation of the splanchnic nerves and they also join the lower seven thoracic ganglia to the gangliated cords which enter into the formation of the splanchnic nerves.

Concussion over the third to eighth dorsal vertebræ then will stimulate the splanchnic nerves which control the vascularity and muscular tonicity of the abdominal viscera.

Concussion over this region of the spinal column

excites especially the splanchnic reflex of vasoconstriction and will relieve intra-abdominal congestion and at the same time increase the congestion or vascularity of the thoracic cavity and viscera. The increase of the blood supply of the lungs from concussion of the middle thoracic vertebra seems to be due largely to the vasoconstrictor influence of the splanchnic nerves upon the abdominal viscera, and the consequent increase of blood forced into the thoracic cavity.

Fifth Dorsal.—Concussion elicits contraction of pylorus.

Fourth Dorsal.—Concussion stimulates seventh segment of spinal column, elicits contraction of gall bladder, dilates pylorus, contracts pancreas and suprarenal capsules.

Sixth, Seventh, and Eighth Thoracic.—Elicits kidney reflex of contraction.

Eighth to Twelfth Thoracic Vertebræ.—Concussion over the eighth to twelfth thoracic vertebræ affects the lumbar nerves and reflexly affects the pneumogastric nerves whose terminal filaments communicate with the lumbar nerves in the hypogastric plexus. Concussion over the vertebræ of this region affects dilation of the abdominal viscera and also of the heart. In a case of constriction of the liver, constriction of the stomach or constipation from bowel constriction, concussion of the tenth, eleventh and twelfth, more especially the eleventh thoracic, is especially indicated.

Ninth Thoracic.—Concussion stimulates first lumbar segment, distends gall bladder, stimulates bladder, affects anæmia, chlorosis, Bright's disease, and locomotor ataxia.

Concussion over the spinous process of the twelfth thoracic vertebra while exciting a dilatory influence over the abdominal cavity at the same time causes vasoconstriction and contraction of the pelvic organs.

Concussion of the twelfth thoracic elicits reflex of constriction and stimulation of the bladder and prostate.

First, Second, and Third Lumbar.—Concussion over this region affects the central origin of the sacral nerves and the spinal exit of the upper lumbar nerves. Their influence seems to be that of vasoconstriction of the abdominal organs, and also of the pelvic organs.

Adjustment of the second lumbar affects vasoconstriction of the lower bowels. Concussion over the same vertebra seems to produce the same effect as adjustment, which seems to be due to the stimulation of the second pair of lumbar nerves at their special exit by either adjustment or concussion.

Concussion over this vertebra is especially useful in congestion of the liver, spleen, stomach, intestines, and uterus.

Fourth and Fifth Lumbar Vertebræ.—Concussion over the fifth lumbar vertebræ produces vasoconstrictor influences upon the pelvic organs, and this is especially marked in the treatment of the bladder and rectum.

In concluding the above remarks concerning the influence of the different centers we especially urge a careful study of the relation of the spinal exit of nerves to their centers of origin, and also urge that adjustment that will relieve all interference with nerves, should be given to insure freedom of the transmission of the physiological impulses so that stimulation by concussion may have the maximum results.

Relief of all contractions of the spine interfering with the exit of the spinal nerves will remove pain in every case. Stimulation of spinal nerves by concussion over their points of origin will increase the impulse generated and transmitted, and elimination will insure perfect results from nerve impluse in the zone we desire to affect.

PART FOUR.

SPONDYLO-SYMPTOMATOLOGY.

CHAPTER I.

THE NORMAL SPINE.

THE normal spinal column is from two feet to two feet four inches in length; consists of twenty-four movable vertebræ (which are called vertebræ from the word "vertero," which means to turn) and other tissues as follows:

Besides the bony segments or vertebræ, the spinal column consists of intervertebral cartilages, ligaments, tendons, and muscular tissues, and there is contained in the neural canal, the spinal cord, lymphatics, and blood vessels; and within the tissues of the spine, terminal nerve endings and a capillary system, and there is attached to the thoracic portion of the spinal column on either side, twelve pairs of ribs.

The true vertebræ of the spine are divided as follows:

1. Seven cervical vertebræ.
2. Twelve dorsal vertebræ.
3. Five lumbar vertebræ.

The length of the spinal column in the different regions is approximately as follows:

1. Cervical region, 5 inches.
2. Dorsal region, 11 inches.
3. Lumbar region, 7 inches.

In addition to the above, we have what may be termed, a part of the spinal column, consisting of original five sacral vertebræ and four coccygeal vertebræ. These in adult life are anchylosed. Before fusion of these bones, we have thirty-three segments in the spinal cord, including both the true and the false vertebræ. After

anchylosis we have twenty-six vertebræ, twenty-four being movable; the other two, sacral and coccygeal, formed of nine original vertebræ, constitute the two false or immovable vertebræ.

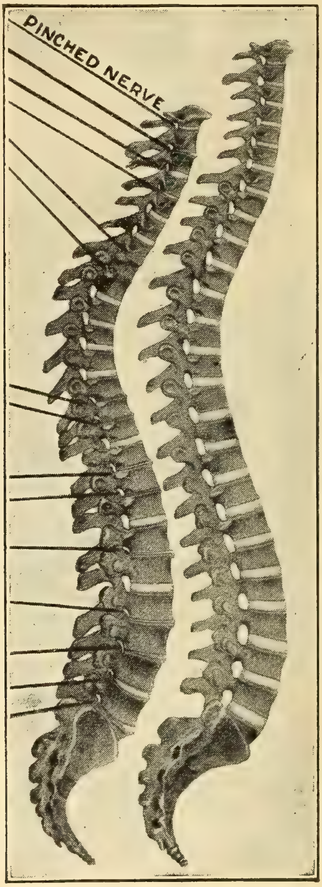


Illustration showing a normal and an abnormal spine, and the effects of lesions of the spine upon the intervertebral foramina.

The spine, normally, has an anterior curvature in the cervical region, beginning with the axis, and extending

to the second or third thoracic spinous process; a posterior curvature in the thoracic region, extending from the second thoracic to the tenth spinous process of the tenth thoracic, and an anterior curvature in the lumbar region, beginning with the spinous process at about the tenth thoracic vertebræ, and ending with the lumbo-sacral articulation. Each vertebræ consists of the following:

1. One centrum.
2. Two pedicles.
3. Two laminæ.
4. One spinous process.
5. Four articular processes.
6. Two transverse processes.
7. Two articular surfaces of centrum.

The pedicles and laminæ, together with the centrum, form the neural arch of each vertebræ, and the consecutive neural arches form the neural canal, which contains the spinal cord, and protects it from injury.

The neural canal varies in size and shape in different portions of the spinal column.

It is triangular in shape, and is largest in the upper cervical region.

The neural canal is nearly round, and is the smallest in the thoracic region.

It increases in size below, so that the lumbar neural canal is larger than the thoracic portion of the neural canal, but is smaller than the cervical. The lumbar neural canal is triangular in shape.

The discs between the vertebræ vary in thickness in the different regions of the spine. The thinnest intervertebral cartilage is between the third and seventh thoracic vertebræ; the thickest intervertebral cartilage is between the lumbar vertebræ.

The anterior common ligament is the largest, strongest and longest of the spinal column. It covers the bodies of the vertebræ in front—and it is this ligament that

gives great strength to the spine, and enables beasts of burden to carry their heavy loads upon their backs.

We also have the posterior common ligament that covers the back portion of the spinal vertebræ, and lines the front of the neural canal.

We have accessory ligaments between the laminæ, and between the transverse and spinous processes.

The spinal cord is from 16 to 18 inches in length, and terminates on a level with the lower border of the first lumbar vertebra.

1. The spine, because of its flexuous contour, and because of the elasticity of the intervertebral discs, protects from the effects of jars or shocks.

2. The spine is the central pillar and support of the weight of the trunk and head.

3. The spinal vertebræ furnish attachments for the ribs and for the erector muscles of the spine, which support the spine in its upright attitude.

4. The spinal column furnishes a canal for the passage and protection of the spinal cord from the brain to the lower end of the spine.

5. The spine is a flexible and flexuous column, and is susceptible to many varieties of movements. The principal movements of the spine are:

1. Flexion.
2. Rotation.
3. Extension.
4. Lateral rotation.
5. Compound movements.

These movements are more free in the cervical than in any other region, and the flexibility and rotation of the spine varies considerably in different persons, and decidedly in different forms of life.

HOW TO DETERMINE THE LOCATION OF THE SPINOUS PROCESS OF A VERTEBRA.

LANDMARKS.

1st Cervical Atlas.	The atlas has no spinous process. The location of the posterior arch of the atlas is midway between the occipital bone and the first spinous prominence.
2nd Cervical Spine.	Best recognized as the first spinous process palpated below occipital bone.
3rd Cervical Spine.	Difficult to palpate. It is covered under the large heavy process of the axis, except when the neck is flexed.
4th Cervical Spine.	This is the second spinous process that is palpated below the occipital bone when the neck is in normal position, and the third that is palpated when the neck is flexed.
5th Cervical Spine.	This is the first spinous process below that of the fourth cervical vertebra.
6th Cervical Spine.	This is the second spinous process below that of the fourth, and the first above that of the seventh cervical vertebra.
7th Cervical Spine. (Vertebra Prominens.)	This is distinguished by the prominence of its length, and serves as a guide for counting processes above and below.
1st Thoracic Spine.	This is on a level with the superior portion of the spine of the

scapula, and may be detected by placing thumbs on a line with the fingers above the spines of the scapula on both sides.

2nd Thoracic Spine. This may be best determined by palpating the one below the first thoracic spine.

3rd Thoracic Spine. Corresponds to the inner edge of the spine of the scapula, and is the second process palpated below the first spinous process.

4th Thoracic Spine. This is best located by counting from the first process above, or from the seventh below.

5th Thoracic Spine. This is best located by counting from the seventh below.

6th Thoracic Spine. This is best located by counting from the seventh below.

7th Thoracic Spine. This is on a line with the inferior angles of the scapula when the patient is standing, and a finger's breadth above when the patient lies prone with the arms hanging. Locate by placing thumb on a line between finger just below scapulæ on each side.

8th Thoracic Spine. This may be best located by first locating the seventh thoracic process.

9th Thoracic Spine. This may be best located by first locating the seventh thoracic process.

10th Thoracic Spine. This is a finger's breadth below the attachment of the last

true rib, and may be detected by the prominence of the tenth pair of ribs in the axillary line by following them to the spine.

11th Thoracic Spine. This may be located by counting from the seventh spinous process above, or tenth above.

12th Thoracic Spine. This may be located in the same way as the eleventh.

1st Lumbar Spine. This is best located by counting from the fourth lumbar spinous process below.

2nd Lumbar Spine. This is best located by counting from the fourth lumbar spinous process below.

3rd Lumbar Spine. This is best located by counting from the fourth lumbar spinous process below.

4th Lumbar Spine. This is on a line with the highest point of the crest of the ilium, and may be determined by palpating the sacrum and the fifth lumbar below; or, by placing the thumbs on a line midway between the fingers upon the crest of the ilia on both sides.

5th Lumbar Spine. This is immediately above the sacrum, and below the fourth lumbar spine.

RELATION OF THE EXIT OF SPINAL NERVES TO THE SPINAL PROCESSES.

1st Cervical Nerves. Exit on a level with the interspace between the spinous process of the axis and the occiput.

2nd Cervical Nerves.	Exit on a level with the center of the spinous process of the axis.
3rd Cervical Nerves.	Exit on a level with the spinous process of the second cervical vertebra.
4th Cervical Nerves.	Exit on a level with the spinous process of the third cervical vertebra.
5th Cervical Nerves.	Exit on a level with the spinous process of the fourth cervical vertebra.
6th Cervical Nerves.	Exit on a level with the spinous process of the fifth cervical vertebra.
7th Cervical Nerves.	Exit on a level with the spinous process of the sixth cervical vertebra.
8th Cervical Nerves.	Exit on a level with the spinous process of the seventh cervical vertebra.
1st Thoracic Nerves.	Exit on a level with the interspace between the spinous process of the seventh cervical and first thoracic vertebræ.
2nd Thoracic Nerves.	Exit on a level with the interspace between the spinous process of the first and second thoracic.
3rd Thoracic Nerves.	Exit on a level with the interspace between the spinous process of the second and third thoracic vertebræ.
4th Thoracic Nerves.	Exit on a level with the spinous process of the third thoracic vertebra.

5th Thoracic Nerves.	Exit on a level with the spinous process of the fourth thoracic vertebra.
6th Thoracic Nerves.	Exit on a level with the spinous process of the fifth thoracic vertebra.
7th Thoracic Nerves.	Exit on a level with the spinous process of the sixth thoracic vertebra.
8th Thoracic Nerves.	Exit on a level with the spinous process of the seventh thoracic vertebra.
9th Thoracic Nerves.	Exit on a level with the spinous process of the eighth thoracic vertebra.
10th Thoracic Nerves.	Exit on a level with the spinous process of the ninth thoracic vertebra.
11th Thoracic Nerves.	Exit on a level with the interspace between the spinous process of the tenth and eleventh thoracic vertebræ.
12th Thoracic Nerves.	Exit on a level with the superior border of the spinous process of the twelfth thoracic vertebra.
1st Lumbar Nerves.	Exit on a level with the center of the tip of the spinous process of the first lumbar vertebra.
2nd Lumbar Nerves.	Exit on a level with the center of the tip of the spinous process of the second lumbar vertebra.
3rd Lumbar Nerves.	Exit on a level with the center of the tip of the spinous process of the third lumbar vertebra.

4th Lumbar Nerves. Exit on a level with the center of the tip of the spinous process of the fourth lumbar vertebra.

5th Lumbar Nerves. Exit on a level with the center of the tip of the spinous process of the fifth lumbar vertebra.

APPROXIMATE RELATION OF SPINAL SEGMENTS TO THE SPINOUS PROCESSES.

Spinous Processes.	*Spinal Segments.*
Posterior arch of atlas	First cervical segment
	Second " "
Spinous process of 2nd cervical	Third " "
	Fourth " "
Spinous process of 3rd cervical	Fifth " "
Spinous process of 4th cervical	Sixth " "
Spinous process of 5th cervical	Seventh " "
	Eighth " "
Spinous process of 6th cervical	First thoracic segment
	Second " "
Spinous process of 7th cervical	Third " "
Spinous process of 1st thoracic	Fourth " "
Spinous process of 2nd thoracic	Fifth " "
Spinous process of 3rd thoracic	Sixth " "
Spinous process of 4th thoracic	Seventh " "
Spinous process of 5th thoracic	Eighth " "
	Ninth " "
Spinous process of 6th thoracic	Tenth " "
Spinous process of 7th thoracic	Eleventh " "
Spinous process of 8th thoracic	Twelfth " "
Spinous process of 9th thoracic	First lumbar segment
Spinous process of 10th thoracic	Second " "
	Third " "
Spinous process of 11th thoracic	Fourth " "
	Fifth " "

Spinous process of 12th thoracic. .	First sacral segment
	Second " "
	Third " "
	Fourth " "
	Fifth " "
Spinous process of 1st lumbar. . . .	Coccygeal segment

CHAPTER II.

SPONDYLO-SYMPTOMATOLOGY.

SPONDYLO-SYMPTOMATOLOGY means spinal symptomatology, or spinal symptoms. By this term we refer to those indications we find in spinal lesions which are discovered by palpation and by inspection, and which signify interference with the nerve supply to the different organs or parts of the human organism.

This is an important subject to anyone who would intelligently practice the science of spinal treatment. First, it is an important auxiliary method of diagnosis, especially in that it locates the spinal lesions, which cause interference with the nerve supply to the different pathological zones or viscera; and, also, a knowledge of the spinal symptoms and how to discover them, is a necessary prerequisite to the proper treatment of spinal lesions for the purpose of relieving the nerve supply to any diseased part.

This subject has not been studied carefully as it should have been; in fact, has hardly been studied at all, except by osteopaths, chiropractors, and practitioners of mechano-therapy.

The gross lesions of the spine, especially such as spinal curvature and Potts disease, and other pathological lesions of the spine that destroy its conformation, have been considered by the general medical profession, but it seems they have almost entirely overlooked the more common, more important, and more obscure symptoms that indicate minor lesions which involve the integrity of the nerve supply to the different viscera and organs.

Sometimes it is difficult to detect all of the symptoms of spinal lesions, but in most cases the principal symptoms are easily determined by the touch of the trained palpator.

We wish to enumerate some of the principal symptoms that we elicit by palpation of the spine:

All nerve force or energy that generates function in any part of the body is dependent upon the transmission of impulses from the spinal cord to the organs supplied direct, or to terminal ganglia of the sympathetic, which are responsible for its functional activity.

Whether an impulse is generated in the brain or in the spinal column, or whether an impulse is the result of an afferent stimulation, it is always transmitted by means of efferent nerves from the spinal column outward to the organ or part supplied. This is due to the fact that efferent nerves are only prepared for the reception of impulses at their central ends, and only transient nerve impulse in a centrifugal direction.

The nerve energy, or nerve force, or the vital energy, or vital force, or, what we consider a better name, nerve impulse, must all come from the spinal column, and it is for this reason that we should give due consideration, and study more closely than we ever have, the existence of spinal lesions, and symptoms which indicate interference with the integrity of the spinal nerves, at their point of exit from the neural canal, consequently with the transmission of the nerve impulse.

We might, without due consideration, decide that the spinal nerve sheath could not become involved in such a way as to interfere with the nerve supply to an organ. We might feel assured, that owing to the ligaments and tendons of the spine and their abundance and strength, that so perfect a structure and arrangement would be proof against vertebral subluxations or malapproximation to such an extent as would interfere with the nerves making their exit therefrom. We may judge that any kind of a subluxation would be absolutely impossible owing to the general strength and arrangement of the musculature and the bony structures of the spinal column.

Many people, when they first hear of osteopathy, think it is a fraud, and many think that when the osteopath speaks of vertebral lesions, that he is visionary, but by a careful study of the work osteopaths have done, we are convinced that there is virtue in their methods, and instead of condemning their practice, instead of prejudging and saying there is nothing in their work, we should investigate and know wherein the merit of their treatment lies.

Many are outspoken against spinal adjustment as a method of treatment, and while they do not pretend to speak from experience, or knowledge, or reason, yet, notwithstanding the lack of all these, they presume to inform the dear people "that there is nothing in such treatment."

"Drugless cures are a fact, and they have come to stay. Medicine has been here a long time, and will stay until we change our drugs for the leaves of the tree of life in the better land."

When the writer first heard of chiropractic, he thought it was a fraud, but by a combination of circumstances he became convinced that there was something that could be accomplished by spinal adjustment. After investigation, I have been surprised what could be done by correcting spinal lesions, but in order to be able to correct spinal lesions, it is necessary that we have a comprehensive knowledge of them, and of the methods of determining them.

I feel confident that if we were able to relieve all spinal interference which may impair the integrity of the normal nerve supply, that we will be enabled to restore normal function, and also to correct the normal histological conditions, especially of the cellular structures that have suffered as a result of the derangement of the processes of metabolism, provided the alteration is not

too great or the waste products of metabolism not too abundant.

In our study of spinal lesions, we are studying them with a view of determining the more obscure lesions, and after locating them, to relieve the contraction of the musculature of the spine that is causing the impingement upon the integrity of the normal nerve supply.

When by inspection of the spine we determine certain symptoms or lesions that are very manifest, we may see malconformation of the spine in many cases, and we may enumerate the different phases of such lesions under the following heads:

I. Torsion.
II. Settling.
III. Lordosis.
IV. Kiphosis.
V. Scoliosis.
VI. Malalignment.
VII. Approximations.

I. Torsion.—This is a condition in which the spine or one or more vertebræ thereof are twisted upon their axes. This condition may be manifested by patients when walking. They may walk with one shoulder apparently ahead of the other, or with one hip ahead of the other. Torsion is associated, to a certain extent, with scoliosis, and other deviations from the normal outlines of the spinal column.

II. Settling.—A settling of the spine may be uniform throughout, or it may be confined to a certain region or regions. Uniform settling of the spine will come on with age, but the amount of settling in the different portions of the spinal column will vary in proportion to the original thickness of the intervertebral cartilage, and in proportion to the superimposed weight upon different portions, and in proportion to the effects of the contraction of the musculature in special regions.

Settling of the spine coming on with age, is also proportionate to the habitual fatigue and muscle tire, and also proportionate to continued interference with the tonicity of the erector muscles of the spine, and also to a constant amount of interference with the physiological nerve impulses, which maintain the tonicity of the erector spinal muscles.

III. Lordosis.—Lordosis is a forward bending of a segment of the spine with reference to adjacent segment below and above.

As the patient stands erect, we have an inward anterior bending of the spinal column, and an abnormal concavity of the back in a certain portion.

If the patient lies on a table, then we have an unusual and sometimes abrupt downward curvature of a segment of the spinal cord.

Lordosis is more apt to affect the thoracic region, and is much more discernible in that region than in any other, because of the fact that we have normally a backward curvature in the thoracic region, while there is a forward curvature of the spine in the cervical and lumbar regions.

IV. Kiphosis.—By kiphosis is meant a lesion just the reverse of lordosis. It is a backward posterior, or outward abnormal curvature of a portion of the spinal column, and may affect any portion of the thoracic or lumbar regions. It is a condition that we find in connection with Potts disease, and also a condition that grows or increases in the upper thoracic region of people as age comes on.

V. Scoliosis.—Scoliosis is a lateral condition, or lateral curvature of a segment, or of the entire length of the spinal column. Often scoliosis is double in its effect upon the contour of the spinal column and a curvature is then to both sides, forming an outline of the spinal column similar to the letter S.

In a great many patients we find a long sweeping curvature of the spine to the right, extending from the top of the thoracic spine, down to the lumbar region.

VI. Malalignment.—Malalignment of vertebræ is a deviation from their normal alignment, and is indicated principally by the position of the points of the spinous processes and also by the position of the transverse processes.

Any contractured condition of the musculature of only one side of adjacent vertebræ, will throw the spinous processes of the vertebræ affected out of perfect alignment, and many unwittingly think that the vertebra has slipped out of its place. Any condition that contracts and approximates one side of the spine and contracts cartilage of one side between two or more adjacent vertebræ, will, if the condition continues a sufficient length of time, cause a decrease of the thickness of the intervertebral disc or cartilage on the side of the contraction.

This will produce a condition of malalignment of the spinous processes. If the contracture is of the same amount on both sides, then there is a uniformity of the compression upon the intervertebral cartilages, and a general thinning, but there will be no deviation from the normal alignment of the spinous processes in the latter case. However, there would be a general approximation, and consequently an interference with the spinal nerves passing from both sides, either directly by impingement, or by interfering with the nutrient supply to the spinal centers in the spinal column.

VI. Approximations.—Approximations which are local in effect, means a thinning of the cartilages between two adjacent vertebræ. This may take place in the thoracic or in the lumbar regions, or, in fact, any portion of the spine.

The tendency to contraction on both sides of the spine from an afferent irritation, is a natural result of

the spreading of the impulse of irritation from one side of the cord to the other.

A continuation of a contracted condition between two spinal vertebræ will cause a permanent thinning of the intervertebral disc, and consequently with the size of the intervertebral foramina.

We will next call your attention to evidences of spinal lesions that we may discern in certain objective and subjective symptoms:

I. Contractures.
II. Tender nerves.
III. Malalignments.
IV. Pain, any variety.
V. Deranged function.
VI. Specific symptoms.
VII. Anatomical lesions.

The above list of evidences of spinal lesions are not those which are manifest, as is the former list given, but such as may be elicited by an examination of both subjective and objective symptoms.

I. Contractures.—A contractured condition is a condition of contraction remainder existing in the musculature of the spinal column. This can usually be determined by palpation, and sometimes is sufficiently manifest to be discerned by inspection.

By passing the fingers along down the spine, palpating on either side of the spinous processes, you will frequently notice that the tissues are absolutely normal for some distance, when all of a sudden you discover or palpate a segment or portion of the spine where there exists a little thickening of the muscles and tendons, or an indurated condition which insures us at once, that there is something wrong with the musculature of this portion of the spine.

Muscular contraction never occurs except as the result of nerve impulse, and when we find excessive

impulses and excessive contractions resulting in contractured conditions, we know there is a mechanical irritation that is making inroads upon the integrity of the normal nerve supply to the muscles of this segment of the spine.

An increased temperature in any segment of the spinal column, is indicative of an inflammatory or an acute pathological process in the zone receiving its nerve supply from that segment. This symptom is associated with acute lesions and acute diseases.

Any local decrease of temperature of a spinal segment indicates a lack of thermogenesis and also the lack of other afferent functions of the nerve or nerves from the spinal segment so affected. This symptom is associated with chronic lesions and paresis.

Muscular contraction or muscular bands along the spinal column are positive signs of interference and irritation of the spinal nerves of that portion of the spine.

Muscular contraction is present in both acute and chronic lesions. The indurated muscles associated with chronic lesions are peculiar in their characteristics, and by this means we may differentiate between acute and chronic lesion.

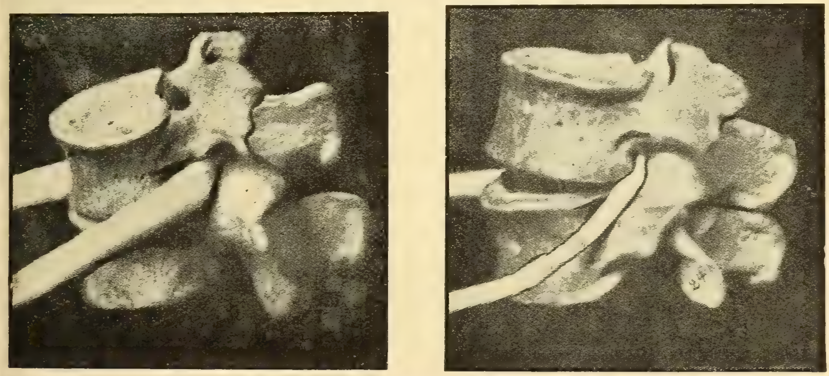


Illustration showing the exit of the neural sheath. On the left is an unimpinged nerve sheath, while on the right is an impinged nerve sheath and reduction in size resulting therefrom.

Nerves may be irritable, excitable, and acting excessively because of a partial anæmia or congestion of the spinal segment, from which they originate. This is usually indicated by the nerve sheath being full and thickened, so that you feel it roll under the finger, and it will therefore be quite easily palpated.

II. Tender Nerves.—Tender nerves in the dorsal region near the spinal column, indicate a mechanical interference involving the integrity of the cellular tissues of the nerve, and this is caused by an impingement of sufficient magnitude to not only interfere with the vascular tissues that pass through the foramen, but also to impinge upon and injure the fibers of the nerves.

We have verified the truthfulness of the nerves being slightly impinged, in hundreds of cases. This we know to be so, because when a thrust is given to relieve the contracted musculature of the spine, approximating the vertebræ, where the tender nerve makes its exit, we will quickly relieve the tenderness of the nerve. It is an impingement of nerves sufficient to interfere with their cellular structures in practically all cases, which produces tenderness of the nerves. We seldom find a case in which the relief of the tenderness of the nerve is not immediate, or following soon after overcoming the contraction that approximates the vertebræ. For this reason, tender nerves are not only an indication, but a positive sign of spinal lesions or vertebral approximation.

III. Malalignment.—In reference to malalignment as a sign of spinal lesions, we refer to the alignment of the tips of the spinous processes of the vertebræ. Malalignment is an indication of spinal lesions in any portion of the spine, and is a positive sign of lesions in the cervical and lumbar regions, and also in the upper and lower thoracic region.

Malalignment of the spinous processes are easily produced by a contraction of the musculature of the spine

upon one side. If two approximate vertebræ are affected by contraction of the muscles upon one side, it at once pulls the bodies, and consequently the spinous processes, out of perfect alignment. See pages 130, 131.

Many will judge that the vertebræ is out of place because they find that the spinous processes are out of perfect alignment, but a little deeper study of the subject will disclose to the average mind that there is a contraction that is responsible for the nonalignment of the spinous processes and also there is an alteration of the approximation between the vertebræ produced.

A contraction of the musculature of the spine on one side is more common than is the contraction of the musculature upon both sides. This is owing to the fact that ordinarily the peripheral irritation of afferent nerves, that reflexly causes the contractions, is usually upon one side and not upon both. There is a tendency, however, in case of severe irritation, for the afferent impulse to pass from one side of the spinal column to the other, and secondarily there is a contraction of the musculature of the spinal column upon the other side also, but in such cases the secondary contraction on the distal side is not as great as it is on the side of the irritation and primary contraction.

IV. Pain—Any Variety.—Pain is the cry of an injured nerve. There must be mechanical interference with a nerve before any pain can exist.

Nerves may be interfered with by impingement of bone when there is bone upon both sides of the nerve, but a nerve cannot be compressed by any other tissues of the body.

We are sure from an extended experience in the relief of pain, that the great majority of all pain is produced by impingement of a nerve at its point of exit from the neural canal. (See Part Two, Chapter X.)

V. Deranged Function.—This phenomena is positive evidence of interference with the nerve supply. While the nerve may not be interfered with directly, it may be interfered with indirectly by an impingement and depletion of the nutrient supply, or by an occlusion of the vessels which drain the segments of its origin—the spinal cord. Interference with the nutrient supply and with the drainage of the cord that affects the functional activity of the nerves, is always where these vessels pass through the intervertebral foramina.

Deranged function, then, is indicative of either interference with the nerve directly or indirectly by mechanical action, and of interference with their nutrition where they make their exit from the neural canal; consequently deranged function is a sign of spinal lesions or approximations.

VI. Specific Symptoms.—Catarrh, retention, lack of secretion, lack of motion, lack of sensation, loss of voice, deafness, and anosmia, are positive signs of an interference with the integrity of the nerve supply that is responsible for these functions, and therefore becomes an indication of spinal lesions by reason of the fact that nerves are interfered with where they make their exit from the neural canal.

VII. Anatomical Lesions.—Anatomical lesions that are not of traumatic origin, are those of lack of development or cellular alterations as the result of interference with the metabolic processes, either in trophic action or retention. As the metabolic processes are carried on wholly through nerve impulse, these functions at once indicate interference with the nerve supply, and consequently indicate spinal lesions causing nerve interference.

CHAPTER III.

SPINAL EXAMINATIONS.

IN making a successful, thorough and complete examination of the spinal column, it is necessary to be familiar with the nature and signs of subluxations, as given in the previous chapter, and with the methods of palpation and of spinal examination.

Following we enumerate and briefly describe the methods of examination that are the most practical, and probably most frequently used by those who practice intelligently the science of spinal adjustment.

POSITION FOR EXAMINATION.—In the examination of patients for the discovery of the indications and the positive signs of spinal lesions, there are certain positions that we prefer our patients to assume and which we consider most favorable for the purpose of examination.

There are certain spinal lesions that are more obvious to the examiner in one attitude than in another.

There are lesions that are manifest, or may be determined, when a patient is in one position, that are more obscure, and cannot be discovered while the patient is in other attitudes.

For the above reasons we find it helpful in spinal inspection and palpation to have patients assume different favorable attitudes when a thorough examination is to be made.

The following positions or attitudes we believe from our experience, are most favorable for spinal inspection and palpation:

I. The Adams position.
II. The erect position.
III. The prone position.
IV. The dorsal position.

The Adams Position.—When the patient is directed to assume the Adams posture, he may do so by standing with his heels approximated and the body bending forward until the head and trunk are in a straight line, and in a horizontal position, and with the hands and arms hanging vertically, while the knees are held unflexed. This is, we believe, the best position in which to detect any twisting or rotation of the vertebræ of the spinal column.

The following observations and notations may be most easily made while the patient remains in the Adams attitude:

1. Note if flexion is unrestricted.
2. Note if flexion is straight forward.
3. Note the alignment of the spinous processes.
4. Note any undue prominence of the angles of the ribs.
5. Note if flexion is normal in different parts of the spine.

Restriction of the action or lack of flexibility of the spine when the patient is bending forward assuming the Adams posture, indicates a settled state of the spine or a contractured condition of the musculature of the spinal column.

If the spine does not bend straight forward, but rotates or curves to either side, then there exists a contractured, thickened and shortened condition of the muscles, tendons, and ligaments of the spinal column upon one side.

When one or more spinous processes are out of perfect alignment, spinal lesions are indicated. Non-alignment of spinous processes constitutes positive signs of subluxation of vertebræ in all portions of the spinal column, except in the middle thoracic region, from about the fourth to the ninth thoracic vertebræ, or spinous processes thereof.

Any undue unilateral prominence or elevation of the angles of the ribs on either side, when they are uncovered by the scapulæ as the patient is flexed in the Adams position, denotes rotation of the vertebræ upon their axes.

Any abnormal stiffness in any segment of the spinal column, indicates a contractured condition of the tissues of that region. Such contractured condition of the ligaments of the spine will engender interference with the spinal nerves and health of the viscera, and other anatomical structures, which receive their nerve supply from the unflexible or contractured segment.

II. The Erect Position.—In assuming the erect attitude, the patient may sit upon a stool, but the preferable plan is for the patient to stand erect with his heels together, and with his hands hanging at his side, while the following observations and notations are being made:

1. Note the spinous processes.
2. Note the angles of the ribs.
3. Note the curvatures of the spine.
4. Note the prominence of the scapulæ.
5. Note the comparative height of the scapulæ.
6. Note the comparative height of the iliac crests.
7. Note the transverse processes of the lumbar vertebræ.

The above observations made while the patient remains in the erect posture, either sitting or standing, are for the special purpose of detecting spinal curvatures and rotation of dorsal and lumbar vertebræ upon their axes.

The difference in height of the scapulæ and of the iliac crests of the innominate bones, is indicative of scoliosis, while lateral positions of the spinous processes and anterior or posterior positions of the transverse processes, and an elevation of the angles of the ribs, indicate rotation of vertebræ upon their axes.

III. The Prone Position.—When the patient is to be examined in the prone position, he is usually placed upon a smooth surface or a flat couch or table that is especially prepared for this purpose, as to length, width, and height.

The proper length of tables for this purpose is about five and a half feet. The width of the table should be from fourteen to sixteen inches, and the height of it should be about sixteen or eighteen inches. The latter dimension, however, should be regulated according to the height of the one who is to palpate the spinal lesions and make the adjustment.

Tables that are made for the purpose of giving spinal adjustment, should be so built that they may be adjusted properly for convenience in spinal inspection and palpation, while the patient remains in the prone position upon the level surface of the table.

The curvatures of the thoracic and lumbar portions of the spinal column that are apparent when the patient is in the erect or standing attitude, are altered and decidedly changed when the patient assumes the prone position upon a flat couch or surface, and the alteration will correspond in amount to the degree of prominence of the patient's abdomen, and the condition and flexibility of his spine.

Certain pathological conditions materially affect the flexibility of the spine, and consequently the changes, which are produced in the curvatures of the spine, by changing the patient from the erect to the prone position, are altered.

1. Deficient tonicity and weakness of the muscles of the spine may result from rickets and other constitutional diseases or weakness existing during a convalescence. Such conditions influence the curvatures of the spine, and there is an inclination toward an increased convexity of the spinal column backward when the patient is in

the prone position, but this convexity may diminish or disappear when the patient assumes the lateral recumbent position.

2. Spondylitis deformans may produce a general and permanent convexity of the spinal column backward. The movements of the spine are diminished or lost, and the changes in the curvatures of the spine are not influenced by movements or by changes in the position of the patient from one attitude to another.

3. We may observe a long continuous curve of the spinal column to either side, which curvature, although permanent, may be altered by changes in the position of the patient, and there may exist a very little or no rotation of the vertebræ on their spinal axes associated therewith.

4. Scoliosis, which is a lateral curvature of the spine, is often co-existent with a straight condition of the antero-posterior surfaces and sometimes with a lordosis—a forward curvature—of the spine between the scapulæ, and these conditions are usually associated with a rotation of the spine, and they always materially change or destroy the natural curvatures of the spine in the thoracic region, and alter the anterior concave curvature of the lumbar vertebræ.

5. In weakened conditions of the spine, as in a hysterical patient, we may have a lateral curvature of the spinal column without any rotation of the vertebræ, but the lateral deviation or scoliosis, will disappear when the patient assumes the recumbent position.

6. In Potts disease we have caries of the centrums or bodies of the vertebræ, which will often permit a sharp curvature of the spine in the thoracic or lumbar region, as a result of the superimposed weight of the body. Such conditions are evidenced by a local, abrupt, and permanent kyphosis.

7. The senile spine is a perceptibly shortened and

stiffened spine, and is the natural result of the settling that occurs as age advances, when the patient is not treated by spondylotherapy methods, sufficient to keep the spine in a normal condition. When the spine is neglected, it will gradually become shortened. The intervertebral cartilages become impacted and thinned. Tendons and ligaments of the spine will become thickened, shortened, and contracted, and in this way the spine loses its length and flexibility, in proportion as the above conditions are increased, as the result of the settling of age. The spinal column of the aged truly bears the marks of the footprints of time, unless a good Samaritan treats the spine and keeps it adjusted and normal.

We can most easily examine and most accurately palpate and determine spinal lesions while the patient remains in the prone attitude. The spinous processes are most easily palpated and the transverse processes are best examined while the subject is in the prone position.

In this same attitude we are enabled to determine the existence of the contractured lesions of the spinal musculature. Also nerves may be palpated if tender or if the nerve sheath is congested and indurated, we are best enabled to discover their condition with the patient prone upon the treatment table.

Nerve tracing can more easily be done in many cases by examination and palpation of the spinal nerves while the patient remains in the prone attitude upon the examination and adjustment table.

The prone position or attitude of the patient upon the examination table is used by many who practice spinal adjustment almost to the exclusion of all other attitudes, and this is the attitude in which many have them remain while giving the entire treatment. This is the best position for giving thrusts upon the spinous processes and for adjustment of the cervical and upper

thoracic vertebræ when using some of the improved methods of adjustment.

IV. The Dorsal Position.—This position is by far the best, and is practically the only position for the patient to assume that will enable us to accurately palpate the spinous processes of the cervical vertebræ.

As the patient lies in the dorsal recumbent position upon the couch or table, the palpator, while standing at the patient's head, may raise it between his two hands, while with the tips of the index and middle fingers he may palpate, and can easily determine the alignment or nonalignment of the spinous processes of the upper two or three dorsal, and of all of the cervical vertebræ.

If the head is flexed sufficiently, the forward curvature of the cervical region will be changed to a backward convexity, and the spinous processes of the cervical vertebræ will be separated so that their alignment may be easily distinguished by palpation.

In this position we palpate to investigate the alignment of the spinous processes of the cervical vertebræ, and also to examine the comparative size of the interspaces between the spinous processes of each consecutive pair of vertebræ.

The advantage of this position in the palpation of the cervical spinous processes, is, that the extensor muscles of the neck are at absolute rest, while the head is being raised, and consequently non-resistant to the palpating fingers. It is only the flexor muscles of the cervical region that may be put in action by the patient, provided he tries to assist the palpator by helping to raise or hold his own head in an elevated position.

If we try to palpate the cervical vertebral processes while the patient is sitting or standing erect, we find them more or less obscured because of the action and slight contraction of the extensor muscles in holding the head erect. We use almost exclusively the dorsal decubitus

position in the palpation of spinal lesions of the cervical vertebræ, especially those lesions which are indicated by the malalignment of the spinous processes.

In spinal palpation we look for all evidence of spinal lesions, both from the standpoint of the condition of the spine, and from the standpoint of the functional phenomena, which are indicative of the spinal condition.

We enumerate below some of the principal symptoms or lesions of spinal articulations that we consider in spinal palpation:

I. Contractures.
II. Nerve tenderness.
III. Thermic alterations.
IV. General condition { Curvature. Flexibility. Muscularity.
V. Superficial tenderness.
VI. Position of spinous processes.
VII. Position of transverse processes.

I. Contractures.—The subject of contracture has been considered quite fully in a previous chapter, and for that reason we will pass it in this connection.

II. Nerve Tracing.—See the next chapter.

III. Thermic Alterations.—This question has been discussed in the previous chapter.

IV. General Outline.—This feature has been considered above, in this chapter.

V. Superficial Tenderness.—Often in certain segments of the spine we find the peripheral tissues tender, which indicates a tenderness of the posterior primary branch of the spinal nerve from that segment.

This tenderness means that the nerve underneath the tender segemnt of the spine, is itself tender. By palpating along the spine, we may readily elicit tender-

ness, which will be manifest by the expression or statements of the patient. Now, if you have done no adjustment to produce a tenderness, then the tenderness must be a result of impingement of the nerve trunk from which the posterior primary division to the tender zone is given off. This is a positive sign of an interference with the nerve that gives off the branch to the tender zone.

VI. Position of Spinous Processes.—We enumerate some of the positions in which we determine the spinous processes to be, by palpation:

1. Superior.
2. Inferior.
3. Anterior.
4. Posterior.
5. Approximated.
6. Left lateral.
7. Right lateral.

These different positions of the spinous processes mean a deviation of the position of the centrums of the vertebræ from the normal. These positions may be easily made out by the trained hand of the palpator. The significance varies in different portions of the spinal column.

VII. Transverse Processes.—The transverse processes are not so easily palpated, as their position is not so accessible to the touch, and more especially is this true in case of excessive muscularity of the spine, or in case of an accumulation of adipose tissue.

In some spines, however, the transverse processes are easily palpated, and we may easily determine any malpositions, and we will enumerate the following abnormal positions, or abnormal indications that we obtain from palpation of transverse processes:

1. Torsion.
2. Approximation.
3. Both superior.
4. Both inferior.
5. Both anterior.
6. Both posterior.
7. Compound malpositions.

For a further discussion of these positions, see Chapter IV., Part Four.

CHAPTER IV.

SPINAL LESIONS.

THE nature of the lesions that occur in the spinal column have received no consideration from the regular medical profession, and are very poorly understood by a majority of practitioners of spinal treatment. The use of the term subluxation gives a wrong impression as to the nature of the spinal lesions such as we have to deal with in spinal adjustment. The laity generally and many practitioners of the healing art do not differentiate the difference in meaning between the terms luxation and subluxation. To so many the term subluxation gives the idea of a vertebra being out of place or luxated. This misconception of the meaning of the term subluxation calls for many explanations by anyone using this term.

The erroneous views held concerning this subject are due also to a wrong conception and wrong teaching on the part of some who pose as leading teachers of chiropractic spondylotherapy. We have heard some teachers claim that vertebræ, from some accident, fall or movement, as the act of turning in the bed, would slip out of place, and also that vertebræ would slip out a little at a time, when turning over in bed, until they would get entirely out of place.

We have heard teachers claim that an adjustment was simply pushing vertebræ back into their place, and if the vertebra when adjusted would not remain in its proper place they would push it back into place again every day until it would remain where it belonged. Such ideas are only entertained by those who know little or nothing of the human anatomy.

A true conception of spinal lesions and of spinal sub-

luxations is very different to what is usually supposed by the laity and poorly or wrongly educated doctors. Anyone with a competent knowledge of the structural formation of the spinal column and its musculature, and with ordinary mental capacity, would know that vertebræ will not be slipping out of place as the result of an accident or movement, nor slipping into place as the result of a thrust upon the spine.

That spinal lesions do exist is a fact, but that they occur in the manner or for reasons, and are of the nature as indicated above, is far from being the true facts in the case.

We may ask the question, why so many uneducated people conclude that vertebræ do slip out of place from trivial causes, and that they slip them back again by an adjustment. To my mind, this is due to the fact of the nonalignment of the spinous processes, as referred to in the previous chapter, which occur as the result of unilateral muscular contraction.

When a contraction interferes with the approximation and alignment of the centrums of adjacent vertebræ, this will of necessity draw the spinous processes out of proper alignment, and this feature of malalignment of the spinous processes is much more marked in the central portions of the thoracic region than in other regions of the spine. This is because of the length of the spinous processes in this region.

As a result of the nonalignment of the spinous processes, and also as the result of the lack of proper alignment of the transverse processes, which may be detected in many cases, we may determine certain peculiar subluxations of vertebræ.

We will enumerate, then, in this connection, some of the apparent subluxations that may be determined as the result of forcing vertebræ from their normal position as indicated by the processes of the vertebræ. Spinal

lesions may actually occur as a result of traumatic violence to the spinal column:

I. Torsion (twisting).
II. Anterior subluxation.
III. Posterior subluxation.
IV. Left lateral subluxation.
V. Right lateral subluxation.
VI. Compound
- Left
  - Anterior.
  - Posterior.
- Right
  - Anterior.
  - Posterior.

VII. Approximated on
- One side.
- Both sides.

Of the different subluxations referred to above, some of them may exist in fact, while most of them exist apparently as a result of unilateral, muscular contraction.

I. Torsion.—Torsion means a twisting of a vertebra upon its axis, and such a condition is indicated by:

1. Lateral position of the spinous process.
2. Anterior position of one transverse process.
3. Posterior position of one transverse process.
4. Anterior position of one of the transverse processes and a posterior position of the other transverse process.

In the cervical region, by a palpation of the spinous processes, we often find one of them to the right or to the left, relative to the adjacent spinous processes above and below.

Now, this lateral condition of a spinous process in the cervical region would indicate a slight torsion or twisting of the vertebra upon its axis. The same indication may be found in the spinous processes of the lumbar vertebræ, and in this portion of the spine we may also have a twisting or slight torsion of the vertebræ.

II. Anterior Subluxation.—The anterior subluxation is a rarity, and rarely occurs in some regions of the

spine, but evidently does exist in certain spines in certain regions.

The fifth lumbar vertebra is wedge-shaped, and the thickened portion of its centrum is anterior. This favors a forward movement of this vertebra. This vertebra also supports the superimposed weight of the entire trunk. Any weights or jars upon the shoulders or the upper part of the body, will spend their force at the lower end of the spinal column, where a movable vertebra joins a solid vertebra, as where the fifth lumbar articulates with the sacrum.

If a person lights on his feet solidly, this will throw a tremendous force upon the fifth lumbar and the sacrum because of a union there between a solid segment and a movable segment of the vertebral column. The ligaments of this portion of the spine are strong as a protection against lesions, but the other conditions of this articulation are unfavorable as a protection.

In the cervical regions we are sometimes able to detect by deep palpation, in which we press the fingers, in front of the sterno-cleido-mastoid muscle, into the deep soft tissues of the neck, an unevenness of the centrums of the vertebræ.

An anterior protuberance is sometimes sufficiently prominent to be easily determined by palpation. For the above reason, we are forced to a conclusion that there must be such a thing as anterior, or a lateral anterior position of the centrums of the vertebræ in the cervical region. In very rare instances we have an indication of a forward subluxation of the bodies of vertebræ in the thoracic region, which is indicated by a deep or anterior condition of one or both of the transverse processes.

III. Posterior Subluxations.—Such lesions do not often occur in the cervical nor in the lumbar regions. Posterior subluxations are more liable to occur in the thoracic region and this is due to the natural posterior

curvature extending throughout this entire region. Throwing the head violently backward is apt to throw the superior thoracic vertebræ backward. In clinical experience we discovered a backward or posterior subluxation of the upper thoracic vertebræ, which, according to the history given, was caused by the kick of a shot-gun. Lifting in a cramped position may cause a backward subluxation in the thoracic regions.

IV. and V. Left Lateral and Right Lateral Subluxations.—Apparent subluxations of this nature may be the result of a unilateral contracture of the spinal musculature, affecting two adjacent vertebræ. There is no doubt that the condition produced in this way explains the cause of all apparent subluxations, to the right or to the left, of vertebræ. It would hardly be possible for a vertebra to move directly to the right or to the left except as the result of extreme violence. Apparent lateral subluxations are more inclined to be of a compound nature as left anterior or left posterior.

VI. Compound Subluxations—The compound subluxations are the more common; in fact, the most probable subluxations of vertebræ, and they may be either to the right or to the left, and the lateral subluxations are more apt to be associated with an anterior or posterior condition of the centrums of the vertebræ.

No doubt the compound subluxations are the more numerous, if not the only kind of subluxations we have of a lateral nature.

VII. Approximation.—An approximated condition of the spinous process or of the transverse processes of the vertebræ is positive evidence of an approximation of the centrums of the vertebræ.

In the unilateral contractions, we have an approximation upon the same side between the adjacent vertebræ affected by the contraction. If, however, we have a secondary contraction on the opposite side, we may have

a uniform approximation of the articular surfaces of the adjacent vertebræ. Unilateral approximation would be indicated by a lateral condition of the spinous process of the vertebræ involved, and would also be indicated by the interspace between the transverse processes of the vertebræ.

A uniform approximation of the vertebral articulation does not affect the alignment of either of the spinous or transverse processes, but it does narrow the interspace between them.

The above conditions or subluxations are practically malpositions in which a vertebra may be forced by traumatisms or by muscular contraction from its normal approximation, and while such conditions are not apparent, there is no doubt of there being a reality of the existence of such lesions in a great many cases.

There is one important point in this connection that might be well to remember. A thrust that tends to throw a spinous process into proper alignment, will of necessity relax the contracted musculature that draws it out of its proper alignment. This fact is in favor of the one making an adjustment or giving a thrust, as ordinarily the careful palpator would apply his thrust so as to throw the processes into proper alignment, and thus affect the tissues that cause nonalignment.

A careless thrust, without regard to the above fact, may fail to accomplish any favorable results, as the contractured tissues would be less yielding than those that were normal; hence a thrust not properly applied would only act upon the musculature that was normal and most elastic, while the contracted and non-elastic tissues would be practically unaffected. This fact emphasizes the importance of careful and painstaking palpation to determine the nature of all spinal lesions.

Signs of Subluxation.—Indications and signs of subluxation are only evident to a person who has made a

study of this subject, and who has had actual experience and training in the detection and classification of the different symptoms and signs that exist.

The different signs of subluxations of vertebræ are not always easy to determine or to discover, for several reasons, one of the principal reasons being, that the muscular tissues may be so heavy over the bony prominences of the spinal vertebræ, and sometimes the other symptoms are obscured because of the abundance of the musculature of the spine which covers up the indications. We enumerate below the signs of subluxations:

I. Pain.
II. Tender nerves.
III. Thermic alteration.
IV. Derangement of function.
V. Malalignment of spinous processes.
VI. Malposition of transverse processes.
VII. Contractures of the spinal musculature.

In the above enumeration of spinal symptoms, we give nearly the same list as we do under the indications of disease. This is because spinal lesions cause deranged function, which is disease, therefore the signs of spinal subluxation become at once the signs of disease. This subject, however, has been practically covered in Chapter II.; therefore we say but little upon the special signs of subluxations in this connection.

I. Pain.—Pain, as stated in Chapter II., is a positive sign of a subluxation, and indicates mechanical interference and irritation of nerves, which can occur only in the human body from internal nerve pressure where the nerves make their exit from the neural canal.

II. Tender Nerves.—By careful palpation along either side of the spinous processes, an inch or two from the median line, we may find nerves that are tender to the touch and we may know that the tenderness is due to a mechanical irritation of the nerves, and is usually

caused by a mild impingement. The more decided mechanical interference, though, will produce pain in addition to the tenderness of the nerve.

III. Thermic Alteration.—In the enumeration of the functions of the nerves, we notice that the thermic control is one of its functions. Any spinal interference with the nerve that will alter or change the functional activity thereof, will alter the thermic conditions in the zone supplied. Any excitation because of slight anæmia, or because of slight impingement, will produce an exaggerated functional activity, and consequently an increased thermic action.

In palpation of the spine we often find segments that are warmer than adjacent segments. This at once indicates spinal interference with the nerve supply, or spinal subluxation. If the spinal interference is excessive and of sufficient length of time, we will have a failure of the normal functioning of the nerve. This at once causes depreciation of the thermo-genetic action, and consequently we will have a cold segment of the spine, as compared with the adjacent segments, below and above.

For the above reasons, a hot and cold segment of the spinal column indicates spinal lesions and interference with the spinal nerve supply to the segment of altered temperature.

IV. Derangement of Function.—As nerves are interfered with where they make their exit from the neural canal, and as they are not interfered with at any other point, or cannot be, except from trauma, we are sure that functional derangement then, is due to spinal interference with the nerve supply, and for this reason functional derangement is a direct index as to the condition of the nerve supply, and any derangement of this phenomena is positive evidence of spinal lesions interfering with the spinal nerve supply.

Under the head of deranged function we might

enumerate some of the different functions of nerves, so as to bring before our minds some ways in which the functional derangement may be manifested:

1. Motion. } Direct. Reflex.
2. Nutrition.
3. Inhibition.
4. Temperature.
5. Mental phenomena.
6. Glandular activity. } Secretion. Excretion.
7. Afferent transmission.

Under the influence of the normal nerve supply there can be no derangement of function, except in cases of trauma or retention, hence the correctness of our statement, that deranged functional phenomena is a symptom of spinal lesions and their results.

V. Malalignment of Spinous Processes.—The position of the spinous process is almost a positive sign of a subluxation; however, near the center of the thoracic region we may have spinous processes that are crooked, and owing to this frequent occurrence of crooked spinous processes in the middle thoracic region, the lack of alignment does not constitute a positive sign, but is only an indication of a subluxation.

In the cervical and upper thoracic and in the lower thoracic and lumbar regions, the alignment of the spinous processes becomes a positive sign in practically all cases of the position of the vertebræ.

VI. Malposition of Transverse Processes.—The transverse processes are more positive signs of the real position of the vertebræ in all regions, than is the alignment of the spinous processes.

We sometimes have difficulty in palpating transverse processes in backs that have a superabundance of muscular or adipose tissues.

If the two transverse processes of the vertebra are more posterior than adjacent spinous processes above and below, then this would indicate a posterior condition of that special vertebra.

If both of the transverse processes of a vertebra are more anterior than adjacent transverse processes above and below, this would indicate an anterior condition of the vertebra to which they are attached.

Contraction between the two transverse processes of any vertebra and those of the adjacent vertebra below or above, would indicate an approximation, while any rotation upon the axis of the vertebra, would be indicated by either an anterior condition of one spinous process, and a posterior condition of the opposite spinous process, or a slight rotation will be indicated if only one of the processes was either anterior or posterior.

VII. Contractures of the Spinal Musculature.—As outlined in the chapter above, they are positive signs of subluxation of vertebræ, and the nature of the subluxation would depend on whether or not the muscular contraction is unilateral or bilateral.

In the chapter above we referred to derangement of function. As a convincing evidence of the fact that contraction of the musculature of the spine is the result of nerve interference, we notice that when we adjust to relieve interference with the nerve supply, that almost instantly, as if by magic, the contraction of the muscular tissues subsides and the hard muscular band disappears.

In our experience we have often seen muscular bands extending from the spine on either side from one or several parts of the spine, and noticed that immediately after adjustment to open up the spinal articulation to relieve interference with the nerve supply, that the muscular bands would disappear immediately and the muscles resume their normal condition.

CHAPTER V.

PALPATION.

PALPATION is one of the principal methods of a clinical examination of patients, which has been long used by all practitioners of the healing art. Palpation may be defined as follows: The act of touching or feeling; or in clinical practice it may be defined as a method of physical examination by the gentle application of the hand or fingers to the surface of the body for the purpose of determining the condition of the surface and adjacent parts of a certain locality or organ of the body.

Palpation, in a general way, is used to determine a number of different conditions, which may be enumerated below under the following headings:

I. Pulse rate.
II. Temperature.
III. Spinal lesions.
IV. Visceral outline.
V. Condition of skin.
VI. Local abnormal size.
VII. Local abnormal shape.

The elicitation of the condition, relative to the matters enumerated above, are all of prime importance, but in this connection our consideration will be principally concerning the art and science of palpation for the determination of spinal lesions.

Formerly palpation has been used for almost any other purpose but that of obtaining data for spinal treatment. The most important phase of the subject of palpation, is that of palpation of the spine for the determination of the evidences of interference with nerve supply.

This method is used almost to the exclusion of all other methods of examination by some, especially those whose treatment is exclusively that of spinal adjustment.

Some of the things that we may determine by palpation of the spinal column, may be enumerated as follows:

I. Pain.
II. Tender nerves.
III. Thermic alterations.
IV. Congested neural cords.
V. Contractured musculature.
VI. Malposition of spinous processes.
VII. Malposition of transverse processes.

The methods of spinal palpation vary considerably among the different practitioners of this art; in fact, it seems a fad among a new school to try to initiate some peculiar and distinctive method of palpation in order to have something entirely different from all former methods. There is a disposition to call black, white, or white, black, in order to make it appear that all former methods have been wrong, and to make the methods of a new science entirely and distinctively different from all former usages and methods.

For this reason there have been certain methods of palpation adopted, used, and taught that are not very practical; in fact, cumbersome and unsatisfactory.

Palpation consists of locating the lesions or conditions or the indications of the lesions enumerated above, and the fingers may be used in any manner according to the custom and practice of the palpator. Some use three fingers almost exclusively in the palpation of the spinous processes of the vertebræ of all the different regions of the spinal column. Others prefer to use two fingers of the same hand, and can detect more accurately the nature of the lesion in this way than they can by the use of three.

In examination of certain regions of the spine, we

find that one finger of each hand is preferable in determining any deviations from the normal, as sensation is less acute when two or more fingers are used.

Position.—For palpation of the spinal column, it is preferable that the patient lie prone upon an adjustment table, and the table should be perfectly level, unless there should be considerable prominence of the abdomen, in which case some provision should be made to make room for the enlargement thereof and to prevent the kyphotic curvature interfering with or destroying the normal contour of the spinal column in case room is not provided.

In this position the muscles may be completely relaxed, with the shoulders hanging over the edge of the table, so that we are enabled to palpate the thoracic and lumbar regions of the spinal column with considerable ease and accuracy.

Most of the abnormal conditions of the spine may be detected in this position, by palpating, preferably, with two fingers. By the use of two fingers the sense of touch is more acute than when three or more fingers are used.

It is also well to pass the fingers along the spinal column while the patient is standing, or sitting in an upright position. By taking this precautionary method of examination, we may sometimes be able to detect certain lesions of the spinal contour that do not appear so plainly when the patient lies prone upon the table.

The use of the upright position, and also the prone position of the patient in making examinations, therefore, is a more perfect way of determining all lesions that may occur, than by the use of only one position of the patient in examination. See Chapter III., Part Four.

Palpating with three fingers has been used in the thoracic region; in fact, in all regions of the spine. An effort is made to pass the tips of the three fingers against three consecutive spinous processes, and in this way to

determine if they are in perfect alignment. This method of determining the position of the spinous processes is very indefinite, however. If the fingers are placed properly against the sides of the processes, it is then a hard matter to judge if they are, or if they are not, in perfect alignment.

A much better method may be used, and for this reason we do not use the three-finger method in any region of the spine, except in the palpation of the atlas. Using two fingers of the same hand is a very practical and a fairly accurate method of determining several points concerning the condition of the spinous processes.

By palpating with two fingers astride of the spinous processes, we can readily detect the size of the interspace between the spinous processes, and any posterior or anterior condition of a spinous process, and also detect any lateral deviation from the normal alignment.

With two fingers the sense of touch is much more acute than with three. For this reason, we almost exclusively use only two fingers in palpation in our practice; we use the tips of two fingers in palpating the spinous processes in all regions of the spinal column.

In palpation of the transverse processes, we find it better to use one finger of each hand, one on either side of the spinous processes. We can detect any elevated or posterior condition, or a depressed and anterior condition of the spinous process with ease, provided the musculature of the spine is not too abundant or too much indurated.

I. Pain.—In palpating for the purpose of eliciting pain, we press gently with one finger by preference over the spinal exit of the nerves.

II. Tender Nerves.—For tenderness, we palpate the interspinous spaces as well as over the spinal origin of the nerves, for the reason that if a spinal nerve is tender, the primary posterior division, to the musculature of the spine, will also be tender, and this tenderness may

be elicited on the top of or in the interspaces between the spinous processes.

III. Thermic Alterations.—By gentle pressure, and by the sense of touch, we may easily detect any alteration of the temperature of any segment or portion of the spine. Alterations are determined by noticing the comparative temperature of the different spinal segments.

A nerve that is irritated, excited, or in any way has its functions increased, will cause an increase of temperature in that zone of the spinal column which it supplies. By the temperature of any zone of the spinal column, we are enabled to determine what nerves are interfered with, as the interference is almost universally at the point where the nerve makes its exit from the spine. We then can relieve the interference with the nerve, by relieving the contracted musculature of the zone of the increased temperature.

We sometimes have conditions of a subnormal temperature of one or more zones of the spinal column. In such cases, we will detect a cold or cooler segment of the spinal column, as compared with the other portions of the spine. This indicates that the nerves from this region of the spine are depressed, and their action is below normal.

The lack of heat production is due wholly to the lack of the thermic function of the motor nerves. We find this condition of cold segments of the spine associated with paralytic conditions and hypo-tonicity.

IV. Congested Neural Cords.—The nerve sheath, in which the nerve and the accompanying vessels make their exit from the spinal column, will, as the result of impingement, become congested, thickened and enlarged. The palpating finger will often detect the nerve sheath as a roll, quite distinctly under it, as the finger palpates by a rolling movement over the neural sheath. It is often difficult to detect the neural sheath, because of the

muscles overlying it, but when the muscles are thin, and well relaxed, then the neural sheath is easily palpated if it is congested and indurated.

Often, however, the muscles over the neural sheath are also contracted, because of the increased motor impulse to the muscular tissues. We have often noticed that the neural sheath which was so easily palpated, would entirely disappear immediately after a thrust for the purpose of relaxing contractures that cause the impingement and the consequent nerve interference and congestion of the neural sheath.

V. Contractured Musculature.—The contracted musculature of the spine is positive evidence of an irritating, stimulating, or exciting influence acting upon the efferent motor nerve to the muscles of the spine.

If a nerve is interfered with in such a way as to be excited, all branches of that nerve may partake of the excitation.

The posterior primary branch of a spinal nerve supplies the musculature of the segment of the spine from which the nerve originates. Then contractured musculature of any segment of the spine is positive evidence of an interference with the nerve from that segment. Often these muscles stand out like hard bands, because of the nerve irritation. These bands sometimes run at an acute angle, laterally from the spinal attachment of the muscles. Incidentally they will mark the location of the spinal contractures that interfere with the nerves.

The masseur undertakes to overcome this abnormal condition by kneading and massaging the muscles. No doubt the massage, kneading or vibration of the musculature of the spine has a sedative effect upon the nerve supply, and reflexly will cause a relaxation, but the time required is considerable in some cases, and the method is too slow for practical use.

There are cases in which spinal massage may be

Illustration of method of marking tips of spinous process and of the graphic manifestation of the malalignment of them.

helpful as a preparatory treatment to our more specific and positive methods of relieving interference with the nerve supply, and consequently relieving the contractured condition that excites the muscular contraction by excitation of the spinal nerves.

It is well to remember that the nerves may be excited or stimulated by a mild impingement or by a slight anæmic condition of the spinal segment. We frequently notice that large contractured bands of muscles will relax almost immediately after an adjustment to relieve interference with the nerves which supply them.

When the muscles stand in ridges, a thrust opening the proper spinal articulations is a specific and immediate remedy for contractured spinal muscles.

VI. Malposition of the Spinous Processes.— Malposition of the spinous processes may be detected in different ways, and the significance of a lateral condition of a spinous process varies in the different regions of the spine.

We may detect lateral conditions of a spinous process in the thoracic and lumbar regions by palpating with two fingers, fairly well, but a more accurate way and a more satisfactory method is that of marking the tips of the spinous process.

Use any pencil that will leave a distinct mark upon the surface of the skin, and mark the length and direction of the center of the tip of the spinous processes. The skin may be drawn carefully and tightly over the process while it is caught and held between two fingers, being careful not to draw the skin to either side. When the process is plainly and clearly felt between the fingers, it is easy to mark the center of the tip of spinous process, and also to mark the length of it.

If all the spinous processes in the thoracic and lumbar regions are marked in this way, we can easily determine by inspection any deviation of the spinous processes

from their normal alignment. This is many times more accurate and more instructive as to the nature of spinal lesions, than are the blind finger tips of a palpator, notwithstanding any amount of training and experience.

VII. Malposition of Transverse Processes.—Malposition of the transverse processes may be palpated with considerable accuracy in the thoracic and cervical regions, but we pay but little attention to the transverse processes in the lumbar region, nor do we pay as much attention to the transverse process of the cervical region as in the thoracic region.

In the lumbar and cervical regions we find that the spinous processes are quite positive indications of lateral conditions, or subluxations.

In the thoracic region the spinous processes are at most but slight indications; especially is this true in the middle thoracic region. In the middle thoracic region, then, we pay more attention to the position of the transverse process than we do to the alignment of the spinous process.

Palpation to determine malposition of transverse processes is almost exclusively confined to the thoracic region. It is best to use the tip of a finger of each hand, one on either side of the spinous processes, in palpating the transverse processes of the thoracic region.

The ease with which we may palpate transverse processes depends upon the amount and condition of the musculature of the spine of the patient. If the muscles are soft, we may, by deep palpation, detect very easily the relative position of the transverse processes, but in case of contractured musculature, or of excessive amount of tissue along the spine, we find it very difficult to palpate transverse processes. In such case as the latter, we must depend upon detecting tender nerves, and upon the condition of the musculature as to bands and contraction remainder.

We would call special attention to the palpation of the cervical vertebræ. With a great many, an accurate palpation of the cervical vertebræ is very difficult.

We use a number of different methods in order to gain information as to the normal alignment of the cervical vertebræ, and even then at times we find it difficult, owing to the indurated and contractured condition of the musculature upon the posterior portion of the cervical region. These indurated segments of muscles may be local lesions or knots. Sometimes they may embrace almost the entire bulk of the muscle.

In the palpation of the cervical regions, in some cases, we find it almost impossible to gain any intelligent knowledge of the relation and alignment of the cervical vertebræ. The following methods may be used:

1. Palpation of centrums.
2. Three fingers for atlas.
3. Palpation of tender nerves.
4. Palpation with head flexed.
5. Two fingers for spinous process.
6. Three fingers for spinous process.
7. Palpation with patient lying on back.

1. Palpation of Centrums.—This is easily done while the patient sits in an upright position.

Standing behind the patient, the operator buries his fingers in the soft tissues of the front of the neck in front of the sterno-cleido muscles.

By a gentle pressure of a palpating nature, the fingers may be brought in close proximity to the bodies of the cervical vertebræ.

By a gliding movement up and down the neck, we are enabled to detect any nonalignment of the centrums of these vertebræ.

Any undue prominence of the body of any vertebra would indicate contractions of sufficient extent to produce malalignment of the vertebra, and a consequent inter-

ference with the nerve supply from this region. The method of adjustment of such lesions is described in the chapter on Methods of Cervical Adjustment.

2. Three Fingers for Atlas.—The atlas may be palpated with the most accuracy by the use of three fingers.

The palpation of the atlas, however, must be of the transverse processes wholly, as it has no spinous process.

Position.—The patient should sit erect, while the operator stands behind.

The tip of the forefinger of each hand is placed against the mastoid prominences, while the second fingers are placed in contact with the transverse processes of the atlas.

The third, or ring fingers, are placed in contact with the transverse processes of the axis.

By making forward and backward movement of the head, we should be enabled to detect any lateral condition of the atlas, or any anterior or posterior condition of the transverse process of the atlas, on one, or on both sides.

3. Palpation of Tender Nerves.—By a gentle penetrating pressure over the spinal exit of the cervical nerves, we are enabled to elicit tenderness, which is a positive sign of slight impingement.

Palpate both sides of the neck back of the sterno-cleido-mastoid muscles for the detection of tender nerves.

4. Palpation With Head Flexed.—Owing to the anterior curvature of the cervical region, we find the spinous processes approximated and difficult to palpate while the head and neck are held in the normal position.

The third spinous process is under, and almost covered by the large and heavy process of the axis, so that it is impossible to palpate it in most cases when the neck is in the normal position.

When the head is flexed decidedly forward, with the

chin resting upon the sternum, we have a separation of the spinous processes of the cervical region. They not only separate, but become more prominent, so that by palpation we may be able to detect any malalignment of the spinous processes of the cervical vertebræ with comparative ease.

5. Two Fingers for Spinous Processes.—While the head is flexed in this way, two fingers of one hand, or one finger of each hand, may be used to palpate the interspaces, and also the condition of the alignment of the spinous processes.

It is almost impossible to have the spinous process of the cervical vertebræ sufficiently manifest to enable us to get three fingers against them, and besides the sense of touch is less acute in using three fingers than when using two. The use of two fingers, then, in the palpation of the spinous processes of the cervical vertebræ, is decidedly preferable to the use of three.

6. Three Fingers for Spinous Processes.—By the use of three fingers the palpator hopes to determine the relative size of the interspaces between the spinous processes and the condition of their alignment.

The method consists of placing the tips of three fingers upon the tips of three consecutive spinous processes, and then by observing the distance between the fingers, he tries to estimate the distance between the spinous processes.

In some necks, when the spinous processes are quite prominent and the neck is decidedly flexed, the three fingers may be used against the sides of the spinous processes, and by this means it is hoped by some to determine their proper alignment.

We consider this method of procedure very inaccurate, and a very poor way of palpating the cervical spinous processes, but we notice this method appears to be

especially attractive to those who wish to be abnormally at variance with every normal procedure.

7. Palpation With Patient Lying on Back.—The cervical vertebral spinous processes may be palpated with the patient lying in the dorsal position, with more accuracy than in any other attitude.

Position.—The patient lies upon the back, while the operator stands at the head.

The patient's head is raised from the table, so as to flex the neck and to make the spinous processes prominent because of the backward curvature of the cervical spinal processes.

In lifting the head, the patient is inclined to assist the palpator, and this will tense the flexor muscles of the anterior portion of the cervical region, while the extensor muscles are out of commission, and for this reason they are soft, flexible, and can be palpated with much greater ease; whereas, in the sitting posture, when the head is thrown forward, the posterior muscles of the neck are in action to a greater or less extent, and in that state of contraction in which they are thrown to help support the head, they form a decided resistance to the palpating finger. This is all overcome by placing the patient in the dorsal position upon the table. The operator, by taking a finger of each hand, can palpate the spinous processes with decided accuracy. In this way we may easily also palpate to determine the alignment of the upper three thoracic vertebræ with almost absolute accuracy.

When we determine the position of a spinous process, we may pass the fingers from the one located to the one immediately above it. In doing so, we detect the size of the interspace, and can also detect any later condition or lack of proper alignment of the spinous processes.

Passing consecutively from one spinous process to another, from the upper thoracic up through the cervical region, we are enabled to detect any variation of the size

of the interspace, or any deviation of the spinous processes from proper alignment that may exist, with more ease and accuracy than by any other method.

A little practice with this method of palpation will certainly make a person very expert in detecting any lesions of the proper relation and alignment of the spinous processes of the upper thoracic and cervical vertebræ.

CHAPTER VI.

NERVE TRACING.

NERVE tracing is the art of following, by palpation, a tender nerve from its spinal origin to some inflammatory or pathological lesion or zone, or the act of tracing a tender nerve from an inflammatory zone back to its spinal exit.

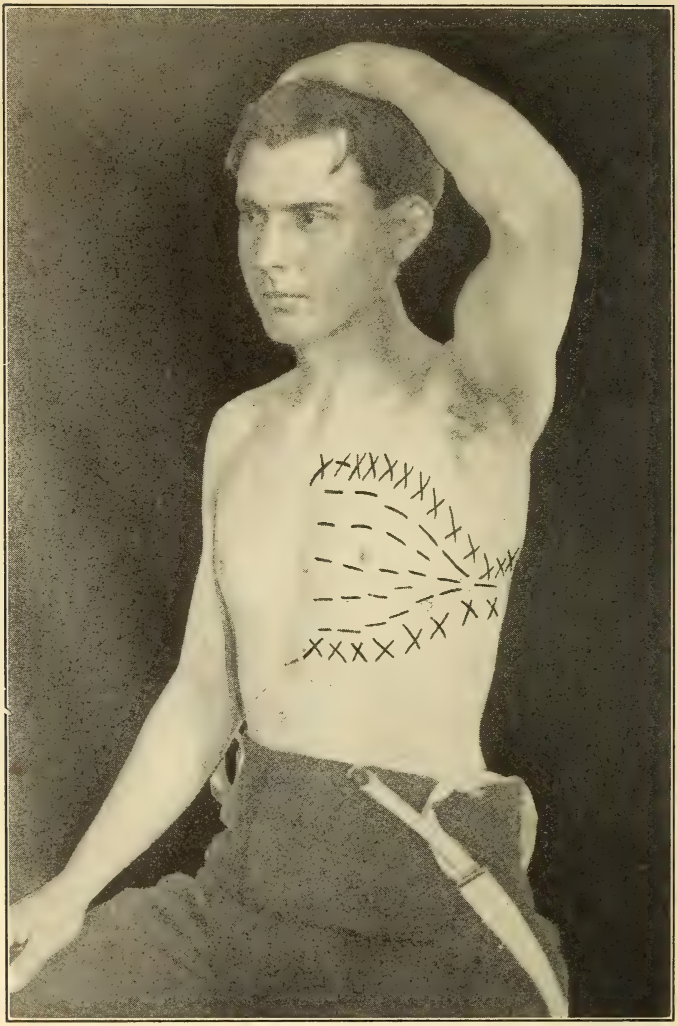
A nerve may be easily traced if it is tender and so situated that we may readily reach it when palpating.

In order that we may be enabled to do nerve tracing, the nerves of necessity must be supersensitive. That a nerve must be supersensitive, we must have some kind of impingement of that nerve; or some kind of mechanical interference affecting its cellular integrity. Such a condition of a nerve is produced ordinarily by some inflammatory process of a greater or less degree in the zone that is supplied by the nerve or by slight impingement where it make its spinal exit.

If the excitability of a nerve is destroyed by reason of heavy impingement, or by reason of continued impingement, or by reason of an occlusion of the nutrient vessels supplying the spinal centers from which the nerve comes, it will then be impossible to trace it.

In the case of lack of sensibility on the part of a nerve, we are unable to take advantage of nerve tracing to enlighten ourselves as to the location of spinal lesions; hence we must look to other spinal symptoms to guide in making adjustments for the relief of those nerves that are nonexcitable or lack sensibility.

We experience no difficulty whatever in tracing nerves in recent lesions or pathological processes that are attended with inflammation as in the case of boils, carbuncles, etc. The existence of pain shows that the



An illustration of the tender region in a case of pericarditis. Straight lines show the location of the tender nerves, and the x shows point not tender. Nerves come together, and trace to one spinal foramen.

nerve is alive and sensitive, and in such cases we have no difficulty whatever in tracing the nerve supplying the part, from the zone of the pain, back to its spinal exit.

We also note that pain, or any inflammatory process in any zone, will, by reflex contraction, cause tenderness of the spinal nerve supply to the part affected. In case of bacterial infection, and especially after the stage of incubation, and after the production of toxins, which act as powerful nerve excitants, we will have reflex contractions, spinal nerve and muscular tenderness, and these conditions enable us to do nerve tracing, especially the tenderness of the nerve.

Nerve tracing is a method of examination and diagnosis that is, or should be, used very extensively by all who practice the science of spinal adjustment. It is a most interesting and fascinating method of examination. It is also very instructive, because of the light it gives as to the etiological importance of spinal lesions in the production of disease and the location of the spinal lesions, that they may be corrected.

It is very convincing to the patient on whom the tracing is made, as it demonstrates to him the connection between the deranged function and the spinal lesions or spinal interference with the integrity of the nerve supply. Nothing is more satisfactory to a patient than to trace a nerve from any zone of soreness, inflammation, or pain in any part of the body, in which there exists any pathologic process, back to the spinal cord, or to its point of exit from the neural canal, and then by giving an accurate thrust, removing the interference with the nerve, re-establish normal function.

If we trace nerves to the spinal exit where they are impinged, and where pain is produced, we certainly are enabled to do a great work by relieving humanity. In the work of relieving pain, we are permitted to do suffer-

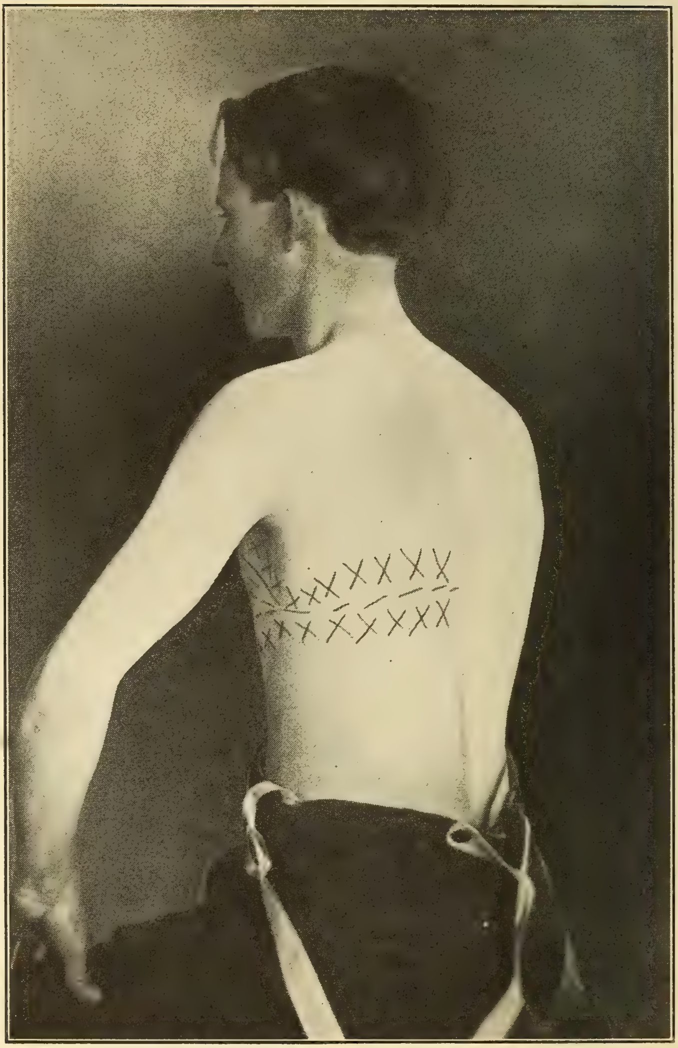


Illustration showing spinal connection of the tenderness palpated in front via a tender tract traced by palpation. Relief of this nerve was effected by a thrust, and the trouble entirely relieved.

ing humanity good, and such work as even the angels might be jealous.

If, after you have located the spinal origin of a nerve, supplying a pathological zone, you by a thrust relax the contractured ligaments of the musculature of that segment of the spine, you relieve that nerve, and in this way relieve the pain and tenderness, this is a most convincing procedure and also a satisfying work that you can do for the patient.

Points to Consider in Nerve Tracing:

I. Methods of holding fingers.
II. Methods of following a nerve.
III. Methods of tracing from spine.
IV. Methods of tracing toward spine.
V. Locating tender points along nerves.
VI. Tracing of the peripheral nerve rami.
VII. Unexplainable nerve tracings in rare cases.

I. Methods of Holding Fingers.—We trace nerves by palpation, and it is often necessary to do so by deep palpation, which necessitates the use of considerable pressure, that we may be enabled to elicit the tenderness of the nerve and determine its tract of continuation. If we palpate with our middle finger, we can possibly do so better because of a better muscular pad on the end of this finger, than there is on the first finger or thumb. By training, we may develop the sense of touch very greatly.

When we find it necessary to do deep palpation with the tip of the finger or continuous palpation for some time, the finger will need some support to prevent the occurrence of muscle tire and exhaustion.

First, we support the palpating finger to increase its strength, and second, we support it to prevent muscle tire, which may soon come on with continuous work. The best method of holding the finger is by placing the first finger on the dorsal surface of the middle finger, and by placing the ball of the thumb against the palmar

surface of the middle finger. In this way we can get a good substantial support for the middle finger, which is the one we should educate for use in palpation and train to continued use.

It is not necessary to hold the finger grasped and supported tightly at all times, but when pressure is made in palpating the support may be tightened, and when we lessen the pressure the support may be lessened, and the repeated alterations in the amount of pressure used in supporting the palpating finger will help to prevent

Illustration showing manner of supporting the palpating finger in case of nerve tracing for any length of time.

muscle tire, both of the palpating finger and the supporting thumb and finger that is being used.

After the palpating finger has been thoroughly trained, its sensitiveness will be greatly increased, and you may trace nerves with a great deal more ease and certainty than without training and practice. When you have located a tender nerve, either at its spinal origin, or at a point approximate to the zone of inflammation, then you must, in a systematic way, follow the nerve either back to the spinal origin, or from the spinal origin to the pathological zone.

II. Methods of Following a Nerve.—When we have discovered a tender point in a nerve track by palpating with the second finger, we should next make pressure at a point in the direction we would judge the nerve is extending. If we fail to place the finger on the tender nerve as we press a half or one inch further along on what we suppose to be the route of the nerve, then we should place the fingers to either side, and by palpating around in a half-moon shape we will again pick up the track of the tender nerve. In this way, step by step, we may follow the nerve from one of its extremities to the other.

Sometimes, that we may be enabled to know from whence, and by what route we have traced a nerve, we find it necessary to mark the tender points. A straight line running parallel with the nerve immediately over the tender points, will give a picture of the course of the nerve on the outside of the body after the tracing has been completed.

There are clinical cases in which, in tracing a tender nerve from a pathological or inflammatory zone back to the spine, we will find that the nerve will branch, or the tender track may be traced to two different points of the spinal column. This is probably because two adjacent organs are involved, or because a nerve supply

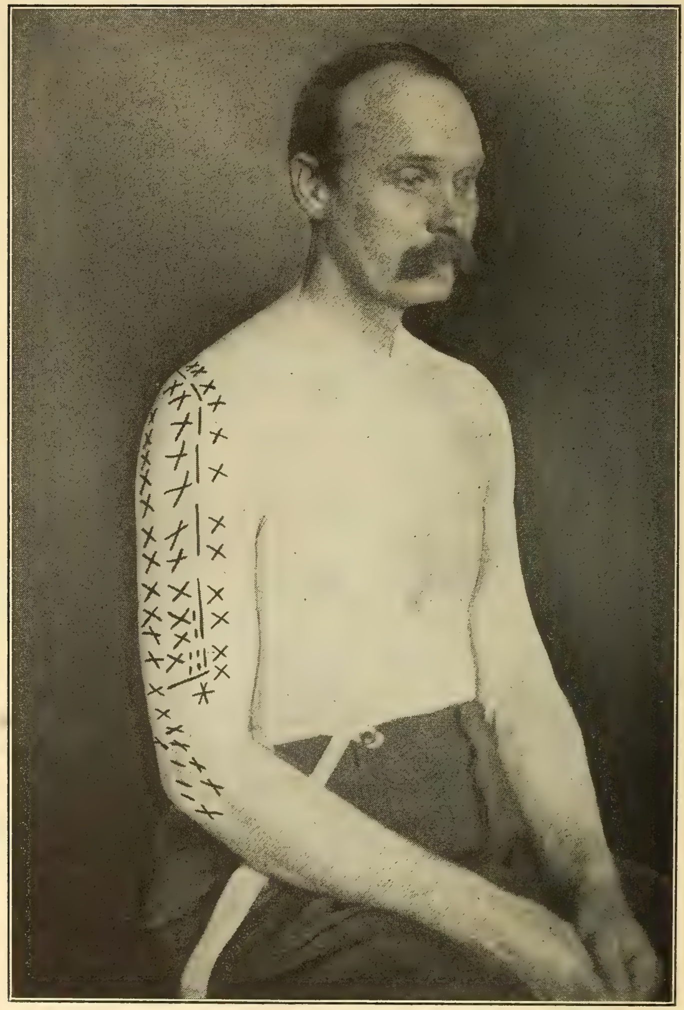


Illustration showing nerve tracing made in case of rheumatism on the front side of the arm.

from two segments of the spine is given off to the same pathological zone and have become involved.

In tracing nerves we sometimes find that they will pass under a bone which will render the palpation of the tender nerves impossible, and in such cases it will escape the impression of the palpating finger. This is true under the scapula and under the clavicle, and also in other parts of the body. If the nerve passes under a bone or tissues through which we cannot elicit its tenderness, we may be enabled to find the spinal origin of that nerve by tracing it as follows:

Trace the nerve to where it goes under the bone. On the other side, where you suppose the nerve may come from under the bone, again try to pick up the tender nerve, by palpating all along the edge of the opposite side of the bone. There will be no trouble in picking up the track of the tender nerve again, and then it may be traced on to the point of its spinal origin and relieved.

III. Methods of Tracing from the Spine.—In tracing a nerve from the spine to any pathological area in which there is an inflammatory condition, we will begin at the spine, and by palpating the tender nerve at, or near its exit from the neural canal, and then step by step we may follow the tender nerve as described above, until we reach the pathological zone.

While nerves may be traced in this way, our experience is that it is not the most satisfactory way of tracing a nerve, for the reason that sometimes mere pressure upon a tender nerve track may allay the tenderness of the nerve or benumb it so that it cannot be traced further. Palpation or pressure of a nerve will affect the distal end of the nerve, and for that reason it is sometimes difficult to trace a nerve from its spinal origin to its peripheral ending.

IV. Methods of Tracing Nerves Toward the Spine.—The method of tracing the nerve to the spine

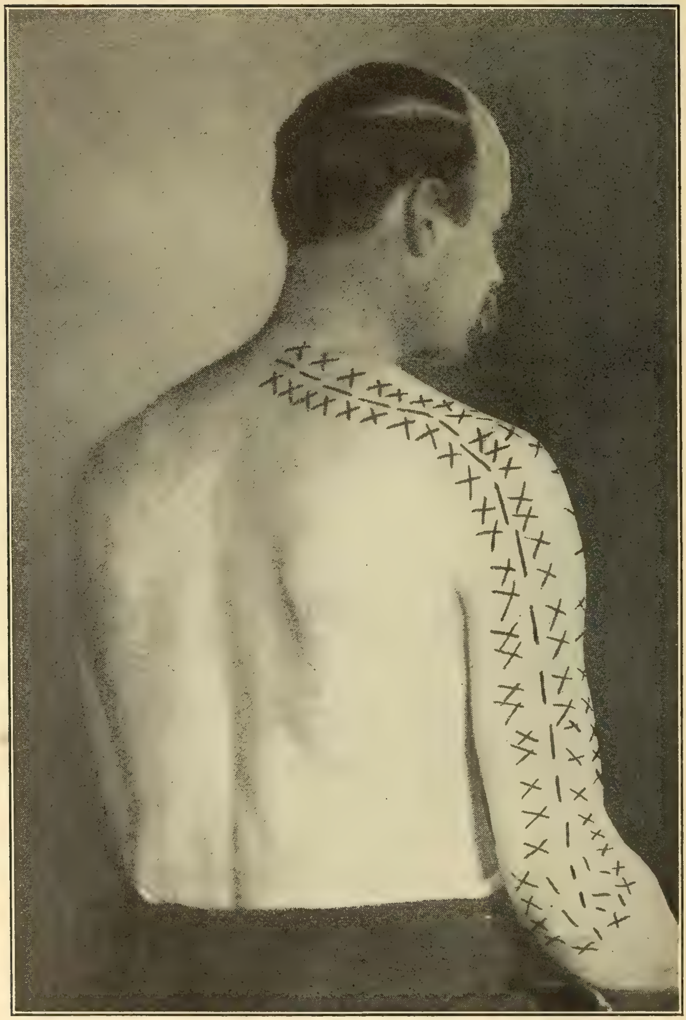


Illustration of the nerve tracing made in case of rheumatism, on back of arm, from elbow to the spinal origin of the nerve.

consists of first locating a point on the track of the tender nerve near the inflammatory area. We should avoid palpating over the tender zone of the pathological process. Palpate back a short distance, and toward the spinal origin of the nerve supply to the inflammatory zone.

When you have located the tenderness in the track of the nerve supplying the pathological zone, then follow it step by step until you reach the spinal origin of the nerve. This can be done satisfactorily and with ease, according to the amount of inflammation in the zone from which we are tracing. While we are tracing, should the pressure upon the nerve benumb its sensibility, only the distal end will be affected. We may continue our tracing on toward the spine, as the proximal end is not so much influenced by any pressure or palpation of the more distant portions of the nerve.

There are many cases that can be traced from center to periphery better than from periphery to center, and in such cases we should trace according to the conditions and the circumstances. We often find that the mere act of tracing a nerve may relieve pain, and that pressure upon the nerves at their spinal origin, will result in temporary relief in many cases.

V. Locating Tender Points of Nerve.—There is another very important point that we have discovered in our work of tracing.

As we trace a nerve from its spinal origin to the region of some pathological zone, we will often locate certain tender points along the nerve that will excite a pain which is referred directly and specifically to the pathological zone. For example: If we trace a nerve from the lumbar region down to a boil on the knee, we will find spots along the track of that nerve that will excite a sharp and decisive pain that will be referred to the location of the boil. We find two, three, or more of

these sensitive points along the track of the nerve in many cases of nerve tracing.

We have noticed in tracing tender nerves to the eye that we find certain tender points, which, when pressed by the palpating finger, will cause a decided sensation to be felt directly in the eye. The irritating sensation that will cause a sense of pain to be felt because of the tenderness of the nerve will carry a transmission of the impulse, not to the zone of the pressure but to the end of the afferent nerve; consequently the sensation is felt in the eye.

VI. Tracing of the Peripheral Nerve Rami.—Nerves, or the branches of nerves that go to internal viscera or organs, cannot be traced, because they are too deep to be palpated, but there is one important fact that will help us in these conditions to correctly determine the location of the etiological spinal lesion.

If a nerve is tender, usually or always all the branches of that nerve are tender, and if we cannot trace a nerve to the inside of the trunk or cavity to the organ affected, we may be able to trace a peripheral branch of that same nerve back to its spinal origin.

We had a very interesting clinical case in our office at one time. An allopathic physician came in and requested the writer to stick some adhesive strips over his ribs, over the right hypochondriac region. He felt that this would tend to hold the ribs more stationary so that he would not feel so much pain during inspiration and expiration.

We suggested to him that we might relieve that pain by relieving the nerve that ramified the painful zone. The doctor remonstrated by saying that there was nothing wrong with his spine whatever, and that the trouble was all in the front and lower part of the chest cavity.

We made a careful tracing in this case. First, we found a tender nerve track between the zone of the pain

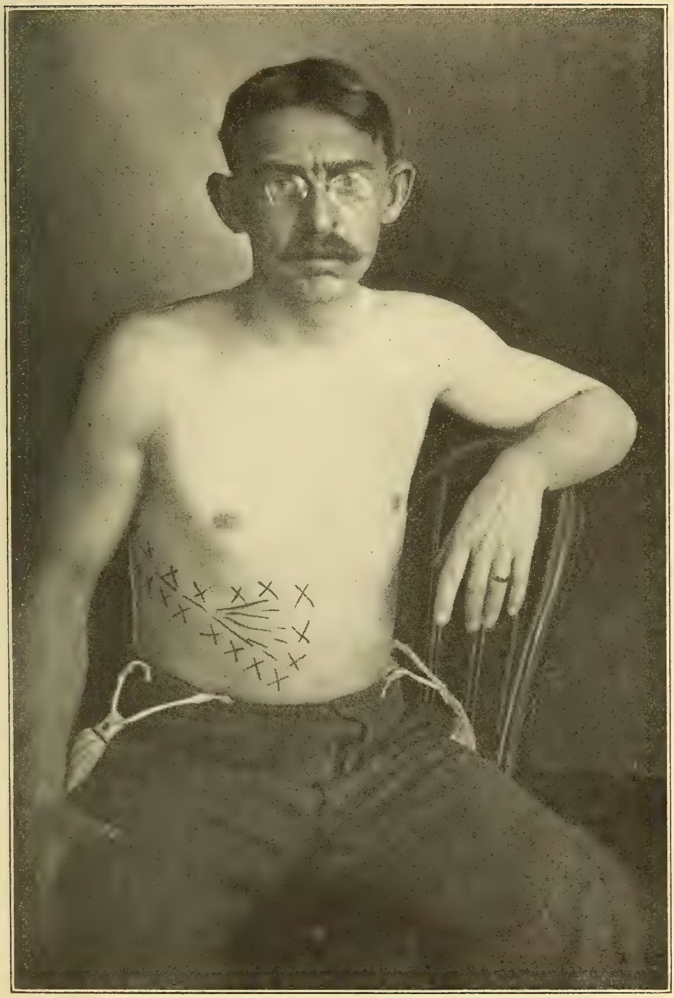


Illustration showing a nerve tracing in a case of pleurisy. Front view.

and the spine, but while so doing, were repeatedly told that there was nothing wrong with the nerve and nothing wrong with the spine, but when we found the tender nerve he flinched and changed his mind as to the spinal nerve being involved.

We made a careful tracing back to the origin of the seventh thoracic spinal segment on the right side. Relieving this nerve did not relieve the pain. Another tender track was followed to the point of the third thoracic nerve exit on the right side. A thrust was then given for the relief of the third nerve that was tender, and we thus overcame the contraction of the spinal musculature where it made its exit from the spine. While the first did not give absolute relief, it did produce quite a decided effect, but the second thrust gave absolute relief, and thus another man was convinced of the connection between pain and muscular contraction of the spinal column.

In this case, however, we could not trace the nerves to the internal organs that were involved, and there was no trouble with the external musculature of the chest. Our tracing, then, must have been wholly that of following the peripheral nerve branches. When we trace peripheral nerve branches, we can most assuredly trace to the proper point or locality of the spinal lesion where we should give relief by adjustment.

This man was no doubt suffering with both an involvement of the pleura and liver, which is just beneath the diaphragm, and no doubt there was trouble with the diaphragm, which intervened between the liver and pleura.

VII. Unexplainable Nerve Tracings in Rare Cases.—We have made many nerve tracings, and some of them we have not been able to harmonize with our knowledge of the anatomical arrangements or of the distribution of the nerves that we traced.

We are puzzled sometimes to know why we find a

Illustration showing the spinal origin of the nerves impinged, and causing the pain in the liver, pleura, and diaphragm.

tender nerve track running in the direction that we do, but there is one thing that we notice: That however erratic a nerve tracing may be, if we trace carefully we are able to relieve the trouble about which we are consulted. We will narrate in this connection examples of two tracings that to us seem to be unreasonable and unexplainable:

A lady patient came to our office suffering intensely with rheumatism, and the seat of the pain seemed to be in the glenoid cavity. She was unable to raise her arm or to use it, or to move it to dress herself. She had thrown a covering over her shoulders and came to our office for relief.

After a hurried examination and nerve tracing, we found a very tender nerve which we traced to the second thoracic region. A thrust to relieve the contraction or lesion at this point, gave absolute relief. She dressed herself and returned to her home in perfect comfort.

After two days she returned again with a second attack of neuralgic or rheumatic pain. This time it was under the clavicle on the right side. The pain was so intense that it involved the use of the right arm, and again she could not dress herself, to come to our office, but had thrown a covering over her shoulders. We expected to again trace a nerve directly to the spinal column, but to our disappointment we could elicit no tenderness between the point of the pain and the spinal column. After carefully investigating a few minutes, we discovered a tender track that passed downward and backward in the axillary region, and the tracing then was made along nearly a straight line to the first lumbar. A thrust was given at this point, but at no other. The result was immediate, and absolute relief was given.

Now, we would be pleased if some anatomist would come forward and explain the connection that existed, and how we were enabled to relieve a pain under the

Illustration showing the origin and tracing of nerves, which we relieved in a case of blindness, and by so doing we restored the power of sight.

clavicle as low down as the first lumbar vertebra that was felt so distinctly, and to be so painful, under the clavicle.

In concluding this chapter, we would call your attention to one more point, and that is, when a nerve is tender at all, it is tender throughout its entire length; consequently any tender nerve will be tender at or near its spinal origin in every case, provided the heavy muscles hinder palpation.

For this reason a careful palpation of the nerves at or near their spinal origin, may enable us to locate the cause of pain at some distal portion of the ramification of that nerve in most cases, and if we relieve all the nerves that are tender at their point of exit from the neural canal, we will be able to relieve all pain anywhere in the body. This we have demonstrated time and time again, but this fact sometimes leads people who do some spinal adjustment into the careless habit of omitting nerve tracing.

Instead of tracing nerves as they should, they simply examine for tender nerves along the sides of the spinal column, and adjust for their relief, and often in this way when they give relief, they do not know from what source the relief came, which removed pain in the certain peripheral point.

There are many strange tracings that are easily understood if we thoroughly understand our anatomy.

We had a remarkable case, that will illustrate this fact, in Pittsburg, Pa., when an M. D., who had suffered for sixteen years with a pain over the right hypochondriac region every time he would draw a full breath, came forward as a subject for nerve tracing. We expected at first when we located the tender zone to trace the nerve from this region directly back to the spine following the intercostal space and nerves. For the first inch and a half, the tender nerve did run toward the spine, following

Illustration showing the front view of the nerve tracing made in the case of blindness, and the termination of the nerves at the orbit of the eyes.

the intercostal space, but suddenly the tender track took an upward direction through the axillary region, and in front of the shoulder under the clavicle, and thence back to the origin of the sixth cervical nerve upon the same side of the painful zone.

Now this at first seemed to be a very peculiar tracing. If we examine the ramification of the long posterior thoracic nerve, we have a solution of this problem. We proved the correctness of this tracing by relieving the articulations between the fifth and sixth cervical vertebræ, and this gave instant relief to all trouble over the right hypochondriac region. The doctor could take a full breath with absolute comfort. The relief was permanent except it was caused to recur a few days later by a maladjustment, but this was quickly corrected.

Nerve tracing and relieving tender nerves by a thrust to relieve the spinal lesion will convince any doubting Thomas possessed of reasonable intelligence, of the importance and potency of spinal adjustment, the less intelligent and prejudiced medical practitioners excepted.

CHAPTER VII.

SPONDYLO-DIAGNOSIS.

THE word "spondylo" refers to a vertebra or to the spine.

Spondylo-diagnosis, then, refers to the diagnosis of disease by the detection of spinal lesions involving the integrity of the nerves to certain organs or zones.

That we may be able to diagnose by palpation of spinal lesions, it is very necessary that we possess a thorough knowledge of the nervous system, both as to its ramifications and the nature of the function produced by the nerves from the different spinal segments.

It is also necessary that we have a good and competent knowledge of the pathological processes to which each and every organ is liable, that we may judge the result of the interference with any nerve supplying an organ or part of the human organism.

Spinal diagnosis is helpful, sometimes, in determining which of two organs is involved. In differentiating, if we have a pain in the region of the diaphragm, we may be at a loss to know whether or not the lesion is of the pleura above the diaphragm, or of the liver, or of some other adjacent organ beneath the diaphragm. By nerve palpation we may often make the necessary differential diagnosis to determine which organ is involved.

The most direct nerve supply to the pleura comes from the upper part of the thoracic region of the spinal column, while the nerve supply to the organs just beneath the diaphragm, come from the central section of the thoracic portion of the spinal column. In such a case, the differential diagnosis is always very easily accomplished. The tender nerve will enable us to decide

whether the pathological process is above or below the diaphragm.

The lungs occupy both sides of the chest, and the tenderness of the spinal nerve supply, especially at the point of exit of the nerve from the neural canal which supplies the lung, will enable us to determine which lung is involved. If the nerve that is tender is on the right side then we may know that the right lung is involved. If the nerve on the left side is tender then we may know that the tenderness is because of involvement of the left lung.

We may be able to make a differential diagnosis between appendicitis and ovaritis owing to the fact that these organs are supplied by different spinal nerves, although these organs receive their principal nerve supply from adjacent segments of the spinal cord.

A knowledge of spinal diagnosis is very important and very helpful to a surgeon in differential diagnosis. We know, that often before a surgical operation, the diagnosis is not clear as to what organ is involved in many cases. Often exploratory incisions are made to determine what organ is involved, and the wisest are often unable to determine before the incision is made what organ is involved, hence mistakes are made. Such mistakes will always be unavoidable while the surgeon continues to use the ordinary methods of diagnosis. With a thorough knowledge of spondylo-diagnosis there is no doubt that much light may be thrown upon a great many cases, and in this way surgery may be made much more scientific than it has ever been in the past.

We refer you to an example that we have noticed in another connection, that will emphasize the importance of a thorough knowledge of spinal lesions, and of differential diagnosis by an interpretation of these lesions. The case was that of a young lady who was to be operated

upon for gall stones, when her trouble was that of pleurisy. (See Chapter X., Part Two.)

The Griffith Bros., of Northern Europe, made a close study of the relation existing between spinal lesions and the manifestation of the accompanying disease. This has been referred to in a previous chapter, but the wonder is now, why has not this line of thought been taken up and taken advantage of long before this time. Probably there has been no greater auxiliary to correct differential diagnosis ever discovered by any one or that may be used by any doctor or surgeon than spinal diagnosis.

A true diagnosis cannot be made from the spine, as is claimed by many, and there are several reasons why an absolute diagnosis is impossible from spinal palpation. Notwithstanding the above there are certain facts that we may determine by spinal palpation and that can not be determined by any other method of diagnosis.

In order to bring before you what we can, and what we cannot determine by spinal palpation, we will call your attention to the difficulties met with in spondylo-diagnosis:

1. Abnormal function variable.
2. Different nerves to visceræ.
3. One nerve to different visceræ.

Abnormal Function Variable.—Abnormal function may vary principally because of the fact that different pathological processes may occur within an organ and we cannot determine the nature of the pathological lesions by spinal palpation. Any pathological process in which there is any inflammatory condition, would be indicated by tenderness of the spinal nerve supply to the pathological zone, but the nature of the lesions would be a matter of conjecture and consequently we cannot correctly judge the nature of the functional derangement.

To illustrate further, we may have different lesions of the kidneys, of the stomach and also of the bowels. We

may know that a certain nerve supplying an organ, is interfered with because upon palpation we find that it is tender, or, we may know that it lacks sensibility, due to a partially paralyzed condition, and yet we may not be able to know the nature of the derangement that is produced by the interference with the nerve, and unless we may be able to determine the pathological derangement, we have not made a perfect or complete diagnosis, or in other words have made no diagnosis except to determine that there is interference with the integrity of the nerve supply to an organ and consequently some derangement of function.

Should we palpate the spinal nerves at, or near their spinal exit which supply the kidneys, and find them tender, we would know there was an inflammatory condition of the kidneys, but we would not know just what the nature of that kidney trouble was. We may say positively that the patient has derangement or functional disorder of the kidneys, but it would require a chemical and miscroscopical examination to determine with any degree of accuracy the pathological lesions and functional derangement that exist in the renal organs.

If we are familiar with the functions of the different segments of the spinal cord, and understand which have the vasoconstrictor and which permit vasodilator action, then we may judge in a way the nature of the lesion of the organ supplied from that special spinal center which is involved.

We find this difficulty in spinal diagnosis: The same nerve will ramify different organs. It may produce one effect upon one organ, and a different effect upon another, and this makes the spinal diagnosis a matter of conjecture in a large measure.

It would be hard indeed to determine whether or not one or all of the organs influenced by a nerve are

involved, unless there is a lesion of some of the other nerves affecting one of the organs.

Several different nerves help to furnish the nerve supply to each and every organ or visceræ. For this reason, although we may know of the functional derangement of an organ, we may be unable to determine what portion of the nerve supply is involved causing the pathological conditions.

We should take into consideration both the subjective and objective symptoms to aid us in making a complete and perfect diagnosis. We should analyze the secretions from the kidneys also as an auxiliary to a correct diagnosis of the nature of their functional derangement. The miscroscope is necessary in many cases in determining the presence of bacteria, animal parasites, and the existence of pathological tissues, etc.

For the above reasons, we take the position that diagnosis cannot be made from the findings of spinal palpation alone. Other auxiliary methods of diagnosis are very necessary and give much additional light as to the correct diagnosis of disease and its processes. Spinal diagnosis, however, taken alone, is probably one of the greatest methods of diagnosis known and practiced to-day.

Diagnosis from the eye is practiced successfully by a few, and we are sure that much may be determined by a close, critical examination of the eye. This, however, requires close study and patience. Some people diagnose from the face, teeth, etc. They give special attention to the diathesis of the patient. We believe that all auxiliary methods of worth should be known and used by the person who would make a good diagnostician.

There has been considerable deception worked upon the public by those who profess to diagnose all diseased conditions by spinal palpation. Many have appeared to be wiser than their fellow men, when, as a matter of fact,

they could not make a diagnosis. To illustrate how this is worked, we will give the following example:

One day a lady called at my office and remarked: "Doctor, I understand that you can tell what is the matter with a person without asking a question." I at once corrected her mind as to such an extravagant claim on my part. She desired that I should make an examination, which I did, and upon palpation of the spine, I found certain lesions, and told her that she had an involvement of six different portions or viscera of her body, and enumerated them. This I did by finding an involvement of nerves at six different locations along the spine, which segments gave most of the nerve supply to the organs that I mentioned as being involved.

For example: There was an involvement of the tenth thoracic, and I told her she had kidney trouble, there was an involvement of the principal nerve supply to the stomach, and from this I told her she suffered with stomach trouble; she had tenderness of the nerves in the lumbar region, and from this I told her she had female trouble, and because of the lack of sensibility and interference with the second lumbar nerves, I told her she was suffering with constipation.

Now, I really had not diagnosed her case. I had told her that certain organs were involved, but she thought that I had made an excellent diagnosis. When I asked the question if I had told her all of her troubles, she replied: "Yes, you have told me all that is wrong with me." I then asked, further, if I had claimed anything was wrong, that was not wrong. To this she responded: "You have mentioned every trouble that ails me, and everything that you have mentioned is true."

Now, this lady really felt that she had had a correct diagnosis, but I knew in my heart that I had not diagnosed the case from her spine; that I did not know the nature of the female trouble, nor did I know the nature of the

kidney trouble; also, I was ignorant of the nature of the stomach trouble. I had simply said these organs were involved, and the patient had mistaken that for a correct diagnosis; she did not know what diagnosis meant, and many are practicing this method of diagnosis and thinking it is diagnosis, when it is really not diagnosis.

There is one thing in favor of this method of diagnosis, and that is: That deranged function is the direct result of nerve interference, and normal functional action of nerves will produce normal function and health.

When we remove all interference with the nerve supply to an organ, we re-establish normal nerve function, provided structural lesions do not prevent, which is the greatest factor on earth in the re-establishment of health, and so we can see it makes but little difference what the functional derangement is, nor the nature of the pathological process, since removal of the interference with the nerve supply re-establishes the normal function, and in this way restores health to the part and in most cases will restore the normal cellular structural arrangement in a sufficient length of time.

It is undoubtedly necessary, however, that in diagnosis we should determine the nature of the kidney lesions both of the pathological processes and deranged functional action, when we can, before treatment, so that when the trouble is removed, we will really know what we have accomplished. For example: We treat a patient who is wearing glasses. After a few treatments the patient does not need the glasses any more. The eyesight is perfect without glasses, and they become a detriment to vision instead of an assistance. Now, if we have made no test of the refractive errors of the eye, we do not know what we have done for our patient.

Now, suppose we have a case of Bright's disease or a case of diabetes. We say to our patient that he has kidney trouble. We so determine because of the involve-

ment of the kidney nerves. The patient gets well under our treatment, but we do not know what we have accomplished. If we have made a microscopical examination and a chemical test of the kidney action, at the beginning of our treatment, then we may know what we have accomplished by our treatment when recovery of the normal function is complete.

We are longing for the day when the science of Chiropractic-Spondylotherapy and other rational methods of treatment will be in the hands of the more intelligent and better educated class of people, but this will not be until the laws of our country regulate the practice of spinal treatment, as well as other methods.

In spinal diagnosis we are enabled to determine, to a certain extent, the location of lesions, by an examination of nerves of certain segments of the spine. We might mention the following spinal segments, and consider briefly what may be indicated by lesions affecting the nerves from these lesions:

1. Upper cervical.
2. Middle cervical.
3. Upper thoracic.
4. Middle thoracic.
5. Inferior thoracic.
6. The upper two lumbar.
7. The lower three lumbar.

Upper Cervical.—By the upper cervical, we refer to the first, second, and third pair of cervical nerves.

If we find tenderness upon palpation of the upper cervical nerves, we would think of lesions affecting the ears, eyes, scalp, and also the nasal passages. These upper cervical nerves influence directly certain cranial nerves, by joining them or their peripheral branches in some terminal ganglia of the sympathetic and thus assist in supplying some of the organs of the head.

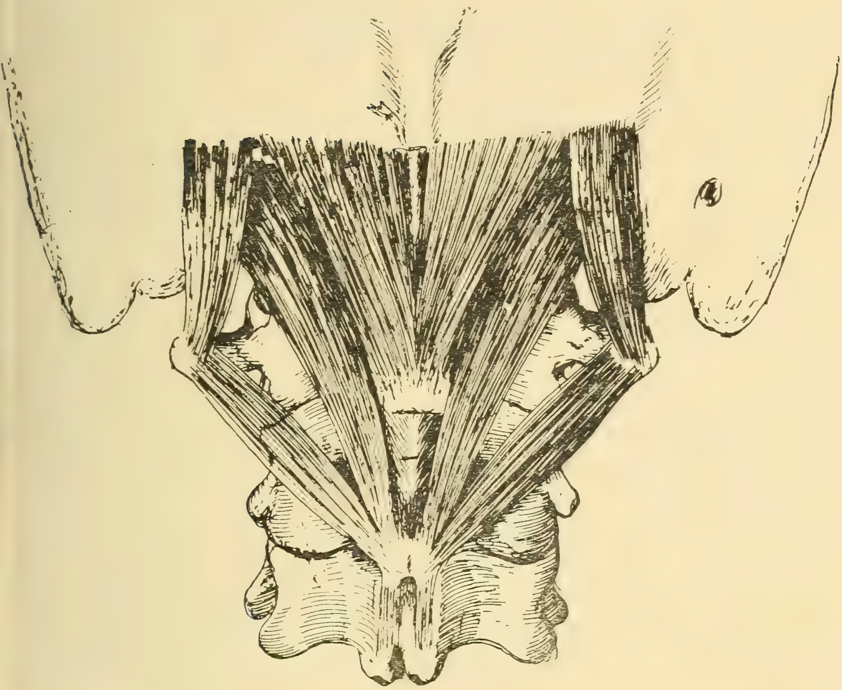


Illustration showing the muscles of the neck, whose contraction will cause approximation of the atlas and the occipital bones, and impingement of the suboccipital nerves.

If we find subluxation, contraction, or interference with the first pair of cervical nerves, we may judge that there may be a disturbance or occlusion of the circulation of the posterior portion of the brain, because any contraction at this point interfering with the nerves, would also interfere with the corresponding intervertebral arteries and veins. If we then have an involvement of the nerves contained in this sheath, we will also have an involvement of the vessels which supply the circulation to the posterior lobes of the brain, and as certain centers are situated therein, we will have certain functional disturbances.

One would be a disturbance of the optic nerves, which arises in the cortical portion of the occipital lobes. In such cases, the eyes grow tired and heavy, and you may suffer with amblyopia.

We notice associated with lesions of the first pair of cervical nerves, that the ear wax is not formed in the ears, normally. Lesions of the suboccipital nerves have to do also with the failure of function of hearing.

We also have, because of interference with sub-occipital nerves, an interference with the nerve supply to the greater portion of the scalp. The suboccipital nerves pass upward and forward, and upon reaching the forehead, they pass downward to the eyebrows. As a result of impingement of the suboccipital nerves, we often have neuralgic headaches.

It has always been thought that the tri-facial nerve was responsible for tic-douloureux, but we find it is an impingement of the upper cervical nerves that is responsible for the trouble, and not lesions of the fifth pair of cranial nerves as formerly supposed. The tri-facial nerve cannot be impinged and it is only the cervical nerves joining it that may be interfered with by impingement. Nasal catarrh is associated with tenderness of the third and fourth cervical nerves.

Middle Cervical.—In the middle cervical region, we have the fourth pair of cervical nerves, and also the third and fifth pairs. The range of the disturbance that is produced by interference with the middle cervical nerves, through various parts of the body, is quite extensive.

1. The upward ramification of the middle cervical nerves affect the teeth, gums, pupil of the eye, and optic nerve.

2. The middle cervical nerves also give off the phrenic nerves, which pass downward and supply the pericardium, pleura, diaphragm, and join in the formation of the solar

plexus. They reach as far as the adrenals in their lower peripheral ramification.

Involvement of these nerves interferes with the expansion of the diaphragm and chest; consequently interferes with the respiration and the circulation and quantity of blood in the thoracic cavity.

When the blood in the thoracic cavity is diminished in quantity, we are apt to have a compensatory increase in the amount of blood in the cranial region, so we have headaches, and other disturbances from the middle cervical region. We have barber's itch, and even hay fever, as a result of fourth cervical vertebral lesions affecting the middle or fourth cervical pair of nerves.

An M. D. in Denver, Colorado, who has taken a course of instruction in spinal treatment, succeeded in relieving an attack of asthma by an adjustment of the middle cervical vertebra although it was a chronic case of several years' standing.

From this region we have our vasomotor and vasoconstrictor influences upon the lungs, and also, to a certain extent, upon the heart. For this reason, percussion with the hand in case of emergency will sometimes revive the patient who is unconscious. This has been taken advantage of many times by persons who were aware of the vasomotor influences of the nerves upon the organs of the chest cavity or because they had an empirical knowledge of the beneficial effects of this measure.

According to Griffith Bros., cervical tenderness is associated with headache, nausea or vomiting, facial neuralgia, fits of insensibility, and affections of the upper extremities. We find this to be true in our experience in spondylo-diagnosis.

Upper Thoracic.—Tenderness in the upper thoracic region is associated with bronchial troubles, lung troubles, cardiac derangement, and also involvement of nerves of this region influence cranial organs by reason of their

connection with the cranial nerves through the upward stream of the white rami communicantes, and the superior cervical ganglia of the sympathetic.

We have had some interesting cases of pleurisy and bronchitis, associated with lesions in the upper segments of the spine, and these troubles are relieved by second and third thoracic adjustment. One lady who had lost the use of her hand, had the normal use of it restored by relieving an interference with the third pair of thoracic nerves. This seems somewhat unusual. Ordinarily, we get more effect upon the arm and hand from the second thoracic nerves as they send the intercosto-humeral nerves into the brachial plexus and into the upper extremities.

The pleura and apexes of the lungs get a direct nerve supply from the third thoracic. We find that the inhibitory center for the heart's action is in the fourth segment of the spine, corresponding in location to the body of the second thoracic vertebra, while concussion of the lower cervical segments of the spinal cord, say over the seventh cervical, has a decided stimulating effect upon the vaso-constrictor influence upon the heart and aorta.

We find that about the second segment we have more of a vasoinhibitory influence, so that concussion over the first and second thoracic processes of the thoracic region, will induce an inhibitory influence upon the heart.

So, in general, in the upper thoracic region, we would diagnose bronchial trouble, pleurisy, lung troubles, and troubles of the upper extremities, and by adjustment at this point we affect these organs, and it is the proper place to relieve cardiac lesions and aortic insufficiency. The ciliary muscles of the eyes are controlled principally by the upper thoracic nerves.

Middle Thoracic.—This brings us to the region of the center of the great reflex system, which is contained principally in the spinal cord.

In the center of this region we have the dividing point of the two streams of white rami communicantes; one of which passes upward, while the other passes downward. Here we begin to affect the organs in the center of the trunk, the stomach, diaphragm, spleen, liver, etc.

We also have from this region, about the fourth thoracic segment, nerves which excite a direct action upon the muscles of the heart. This is a very important region, and one in which lesions are common, and in which they are more general in their effect throughout the different portions of the body.

In the distribution of the fifth pair of spinal nerves, we have quite a peculiarity because of the difference in the ramification of these nerves from the two sides of the spinal column. The nerves from the left side of the spine are supplied to the viscera of the adjacent region and excite a vasomotor influence upon the action of the stomach, while the nerves from the right side are distributed almost wholly to the throat and organs of the head; affecting the eyeballs, tongue, thyroid glands, tonsils, throat, etc.

The sixth pair of spinal nerves are the center of the great reflex system, and affect the organs both below and above their point of exit from the spine. They affect the spleen, liver, and stomach, and other viscera, also the general condition of the nervous system.

INFERIOR THORACIC.—The lower thoracic nerves especially affect the bowels, kidneys, and viscera of the central and lower portion of the abdominal cavity. Any involvement of the nerves to this region would indicate trouble with the omentum or peritoneum, small intestines, kidneys, supra-renal capsules and other viscera.

Lesions here would also indicate a lack of tonicity of the lungs, heart, and stomach, through their connection with the phrenic nerves and through the pneumogastric. Because of the downward stream of white rami com-

municantes, lesions in this region also have an influence upon the pelvic organs.

Upper Lumbar.—The upper lumbar nerves have quite a positive and distinct influence upon the organs they ramify and those they affect indirectly.

The first pair of lumbar nerves have a decided and positive vasomotor influence upon the bladder. They also affect the lower large intestines.

The second lumbar nerves influence the inguinal canal, the large intestines, appendix, sexual organs, and other parts; from this region we may excite a vaso-constrictor influence upon the viscera higher up in the abdominal cavity by percussion, as, for example, the stomach, liver, and spleen may be constricted.

Involvement of the first and second lumbar nerves would indicate bladder troubles, constipation, diarrhea, dysentery, appendicitis, hernia, and we may have neuralgia of the thigh, because these nerves enter into the formation of the anterior crural nerves.

We have associated with these lesions, pain in the abdomen, loins, hips, dysury, etc.

Lower Lumbar.—The lower lumbar nerves enter largely into the formation of the great sciatic nerves, and they influence the rectum, uterus, and other pelvic organs, and from lesions of this region we may diagnose female troubles, lumbago, sciatica, rheumatism, rectal troubles, and other diseases of this region. Affections of the ankles, knees, and other joints of the lower extremities, and diseases of the rectum, are influenced largely by the fifth pair of lumbar nerves.

In the above we have given briefly the diagnostic indications of lesions in the different segments of the spinal column, but have not gone into detail as to the specific indications from the involvement of the different spinal nerves. This subject will be considered more in detail in subsequent chapters in which we consider the ramification of the different spinal nerves.

PART FIVE.

SPONDYLOTHERAPY METHODS.

CHAPTER I.

SPONDYLOTHERAPY METHODS.

THE word spondylotherapy means, literally, spinal treatment. Since our study of spinal lesions, and their relation to pathological processes and disease in general, we feel the importance of giving special attention to spondylotherapeutic methods, as spinal treatment is evidently a necessary procedure after having a knowledge of why disease exists.

There are two questions that come up in connection with every case of sickness, either acute or chronic:

1. What is the cause of the sickness?
2. What is the proper treatment to employ?

The treatment of disease has been presented from almost every standpoint. Not only have we a school that depends upon medicine as its main line of treatment, but surgery, hydrotherapy, massage, suggestion, Christian Science, and many other forms of treatment have been applied for the relief of suffering humanity.

During more recent years, methods of spinal treatment, in vogue in some of the Northern European countries, have been introduced, developed and practiced in the United States. To-day the principal advocates and practitioners of spinal treatment are those who believe in and practice almost exclusively, drugless methods of treatment.

Among the schools of practitioners using the spinal methods of treatment, we find the osteopaths, chiropractors, and those who practice mechano-therapy.

There is no doubt that these systems of treatment all sprang originally from the Swedish massage methods and the Bohemian methods of giving the spinal thrust. The brain of the American people must be credited, however, with having greatly developed, in many respects, these methods of treatment.

We have but little sympathy for the pseudo, self-styled discoverers, and also find that those who have done the greatest work in developing these methods of treatment, are having the least to say, and do not boast about it, while those who have boasted of being its developers are ignorant of the underlying principles of the science of spinal adjustment.

In this chapter it is our intention to consider some of the better and more practical methods of spinal treatment. There is a tendency on the part of some to remain in the rut and to advocate but one method of spinal treatment, namely, the thrust, and but one abnormal thrust; but we like the broad platform of some of the medical schools much better, as they are not so selfish, and are teaching the use and recommending any method for the alleviation of the sick, when they are convinced that a method is meritorious. However, all doctors are not as broad as their professed platform.

The broad education of the medical men of to-day prevents that narrowness that is characteristic of some who are so deep in the rut that they can see only one system of treatment, and that is spinal treatment, and only one method of treating the spine, and that is the thrust, and sometimes only one way of giving the thrust, as is above stated, and which is of the most absurd character.

We are confident, from an extended experience in spinal adjustment, that there are numerous methods of adjustment which possess merit, and are very valuable to any one who would practice spondylotherapy. There

are other methods of treating the spine besides the thrust, which are conducive to the restoration of the normal condition of the spinal musculature. We will enumerate some of the methods of spinal treatment, as follows:

I. Stretching.
II. Masseuring.
III. Concussion.
IV. Sismotherapy.
V. Thermotherapy.
VI. Psychotherapy.
VII. Nerve pressure.

I. Stretching.—It is a well-known fact that the spine settles because of muscle tire as a result of a hard day's work. There is no question but that as a person grows old, the settling of the spine during the day is not entirely overcome by the rest and relaxation of the night, and as the result of this, we see the old man or the old woman's spine growing shorter. Sometimes the intervertebral cartilages of the spinal vertebræ will lose one third or more of their average thickness and this will cause a corresponding shortening of the spine.

When the spine shortens, because the intervertebral cartilages grow thinner, the intervertebral foramina are likewise narrowed; thus we have interference with the integrity of the nerve sheath and its contents.

For all general shortening of the spine, stretching, if properly done, is an excellent way of relaxing the tendons and increasing the thickness of the intervertebral cartilages. In fact, it is the only way which will accomplish results of this kind in a satisfactory manner in a reasonable length of time.

We fully believe that a proper stretching of the spinal column from time to time, will prevent the settling that comes on with age, and will maintain in the spine the proper length and the proper thickness of the inter-

vertebral cartilages, and consequently, the proper openings of the spinal windows for the exit of the neural sheath and its contents.

We may, by adjustment, overcome a local contraction between two adjacent vertebræ and relieve the nerve; in fact, this can be done at any segment of the spine, but we cannot by the adjustment increase the intervertebral cartilages as much or as fast as we can by other methods used, especially that of stretching the spinal column.

Stretching may be done by fastening the feet and head of the patient to previously arranged attachments upon a horizontal table, and then by separating the attachments and bringing a decided tension upon the patient, which will affect the spine quite uniformly throughout. In this case the weight of the body has nothing to do with the amount of tension, but the tension is wholly controlled by the extension of the head attachment from the foot attachment. This is probably a more comfortable way of stretching the spine, and is therefore the favorite method used by a great many people who practice spondylotherapy treatment.

There are many ways in which we may stretch the spine, and of the practical methods that we use in spinal stretching, we enumerate the following:

1. Swaying.
2. Swinging.
3. Manual traction.
4. Bimanual thrust.
5. Vibrato-traction.
6. Traction-adjustment.
7. Longitudinal vibrato-traction.

All of these different methods may be used, and either of them may be advantageous in the treatment of different patients.

1. Swaying.—The act of swaying the spine in such a way as to bring into activity the musculature of the

side of the spine, will develop the lateral musculature. The swaying may be passive or active. There are different positions that a patient may assume, and certain changes in position that he may make, that will call into action the musculature of the spine. There are certain movements that the operator may give or put a patient through, that will bring into activity the musculature of the spine, and thus strengthen and develop it.

Calisthenics, Swedish movements, and all athletic exercises that develop the musculature of the spine, are beneficial because of the bending or swaying that takes place. If a person uses due intelligence in movements and thus brings the musculature of the spine into action, there is no doubt that he can train and develop himself out of certain forms of disease, and also maintain perfect strength and agility.

We will mention a few methods of exercise that will bring into action the musculature of the spine, which we have found to be very beneficial:

Stand with the heels together and knees unflexed; bend forward and touch the floor in front without bending the knees. This movement produces a decided flexion of the spinal column, and the patient may have the most decided effect upon the lumbar region, or upon the thoracic region. Children and young people can easily touch the floor without bending the knees. Many people of middle age cannot at first reach the floor or reach within a foot of it, but if they continue the effort they will gradually loosen up the tissues of the spine until they can get sufficient relaxation to permit enough flexion, to reach the floor.

A good plan is to stand with the hands raised above the head and reach as high as possible; then with a swaying movement forward keep the hands above the head until you bring them down in contact with the floor, while you hold the knees unflexed. If you do not

reach the floor the first effort, try, try again until you can easily reach the floor. Some become so supple and flexible in their spines, as to be able to lay the palms of their hands upon the floor. If a person in middle life will go through this exercise from three to twenty times every morning, he will succeed in keeping the flexibility of the spine normal for years.

Another important movement that can be practiced as an active exercise on the part of the patient, is to hold the arms extended at right angles with the body. Fill the lungs full of air, then rotate the arms and shoulders without rotating the hips. This brings a rotary swaying movement upon the spinal column, and as the patient rotates from right to left and from left to right, each time rotating as far as possible, he is bringing into play the musculature of the spine. This may be repeated for five or ten minutes with most excellent effect. In this exercise almost every or any portion of the spine may be most decidedly rotated at the will of the patient.

Rotation may affect mostly the lumbar vertebræ, or it may affect the lower, and even the middle portions of the thoracic region. In this way the nerve supply to the pelvic organs, to the lower bowels, to the kidneys, and to the stomach, may be freed of the interference, caused by contractured tissues of the spinal column.

A flexion or swaying of the spine from side to side, as the patient stands with his hands upon his hips, brings into play the lateral musculature of the spine, and is decidedly a beneficial movement for the development of the tissues of the spinal column.

Swaying may be accomplished very easily by the practitioner as the patient lies upon the adjustment table. A treatment table may be so built that we can get decided lateral flexions or swaying of the spinal column of a patient with perfect ease. Not only can we get this lateral swaying of the spine by using a properly

built table, but we can concentrate the effect of the principal part of that swaying in any part of the spine that we choose. In this way we relax principally the musculature of the lumbar, and may affect the lower or upper thoracic segments of the spinal column at will.

This treatment does not take the place of the spinal thrusts wholly, but it does relieve the tissues of the spine of people who are so sore and tender that they cannot stand an adjustment, and is especially good treatment for old people who need to have their spinal musculature gradually relaxed. It is an indispensable method on the part of all successful practitioners of spondylotherapy methods, who would make the best success of their work.

2. Swinging.—Swinging is another method of stretching the spinal column, and one that is used considerably, and one that is especially effective and useful in a number of cases.

Different devices have been manufactured for the purpose of swinging the patient so as to bring the weight of the body upon the musculature of the spinal column. A continuation of the weight upon the ligaments, tendons, and other tissues of the spinal column, causes a relaxation and lengthening to take place.

If the head of a patient is placed in a halter and supported by a band under the chin and occiput, the entire weight of the body may be supported entirely by the tissues of the spinal column. The upper segments of the spinal column have the weight of the entire body, while the lower segments have the weight of the dependent portions below their level. The effect, then, is most decided upon the cervical and upper dorsal portions of the spinal column. The weight may be made to affect the lumbar portion of the spinal column mostly, by having the patient swing from a support to the armpits. In this case, the musculature, and especially the latissimus

dorsi, will support the upper portions of the spine, and the strain will fall most heavily on the lumbar portions.

The writer has witnessed the results of stretching of the spinal column by hanging the patient's head in a halter, and has learned that a perceptible difference in the height of a patient may be produced by merely swinging with the body weight resting upon and supported by the musculature of the spine.

An arrangement for this purpose may be manufactured at home and at small expense. The plan ordinarily used, is to manufacture a head halter with a rope attached, which runs over a pulley at the top of the room. Then when the halter is fitted on the head, the loose end of the cord may be pulled through the pulley by the patient himself, or by an assistant.

As the halter lifts the patient until his feet are clear of the floor, the weight comes on the musculature of the spine, but the amount of the stretch, or the tendency to stretch, is most intense at the upper portion, and decreases in intensity as we pass to the lower portion of the spine.

This is just the reverse of what occurs when a patient stands in a natural position. As the patient stands, the body is supported by the spinal column. The lower segments of the spine have more superimposed weight than do the upper segments.

3. Manual Traction.—Simple manual traction is more frequently used as an auxiliary measure in giving specific thrusts to overcome spinal lesions.

We find by a slight traction, which loosens up the musculature of the spine slightly, and opens slightly the vertebral articulations, we can more easily adjust a spinal articulation by a specific thrust, than when no traction is made. Manual traction is almost exclusively made as an auxiliary measure in making adjustments in the cervical region and in the upper thoracic regions. Some of the most effective and specific adjustments are

made in the cervical, and also in the upper thoracic regions when we apply manual traction.

Manual traction is also used in the adjustment of children, and it is an excellent auxiliary in giving adjustments in all regions of the spine of a child.

Specific directions for making manual traction in connection with adjustment of the cervical and upper thoracic regions, will be considered in a subsequent chapter, in which we take up the subject of Methods of Spinal Adjustment.

4. Bimanual Thrusts.—The bimanual thrust is one that is given with one hand, while the other hand is so placed as to produce a traction upon the spinal column. This is usually accomplished by having the pelvis of the patient over a roll. One hand, then, will be placed upon the sacrum, and the other upon the spinous process of the vertebra to which the thrust is desired to be given.

A thrust given in this way in some cases works very nicely, and is an expedient and convenient way of giving a thrust, and at the same time exerting a slight traction as an auxiliary measure for loosening up the articulations that may be impinging the nerve sheath.

5. Vibrato Traction.—Simple traction accomplishes good. Simple traction, plus vibration, is much more effective. The vibration seems to produce a relaxation of the musculature of the spine when given in connection with tension, and much more than simple stretching alone will accomplish. We may apply vibration to the musculature of the spine in different ways:

One way which is most easy and simple, and most frequently used, is to get a tension upon the spine, either by swinging the patient or by stretching the patient upon a table in the prone position. While the tension is upon the spine, we may vibrate the musculature of the spine, and thus assist in the relaxation.

There is practically no expense about vibrating while

the spine is under traction, for the reason that stretching machines are inexpensive and vibrators are comparatively cheap.

The nature of the vibration should be that of massage, as the concussion stroke treatment is not palliative, and does not produce relaxation like the ordinary vibratory movements.

6. Traction Adjustment.—By traction adjustment we refer to adjustment that is made while there is tension applied to the spinal column.

This plan of adjusting, while the spine is under traction, is advantageous in many ways:

1. A spinal contraction may be adjusted, and the articulations may be opened, and the spinal musculature of that segment relaxed more easily, while the spine is stretched, than when it is not under tension.

2. If a spinal articulation is opened by adjustment under tension or traction, the adjustment will be less apt to be painful, and this is an important point. The fact that an adjustment is sometimes instantaneously and temporarily painful is true when the nerve which makes its exit from that special point of the spine is tender.

When adjustment is made without any tension or traction upon the spinal tissues, the mere act of springing the back downward in making the adjustment with the patient in a prone position, temporarily, but instantly narrows the intervertebral foramen. This for the instant increases the impingement upon the nerve, and excites a shock of pain.

When the spine is tensed by stretching, the movement of the articulation, then, is of the nature of a separation without any narrowing of the foramen, and consequently without any pain whatever, because of the fact that the nerve is liberated, and instantly has more room and is freed from impingement as a result of the adjustment under tension.

After considerable thought and experience, we have been able to produce an adjusting table that enables us to have the spinal column under a decided tension when the thrust is given; consequently relief of tender nerves, without producing any instantaneous shock or pain, as is necessarily produced by the practitioner of chiropractic spondylotherapy who adheres to but one idea. This table is simple and inexpensive, while other tables are much more cumbersome and inconvenient, and sell for a handsome price.

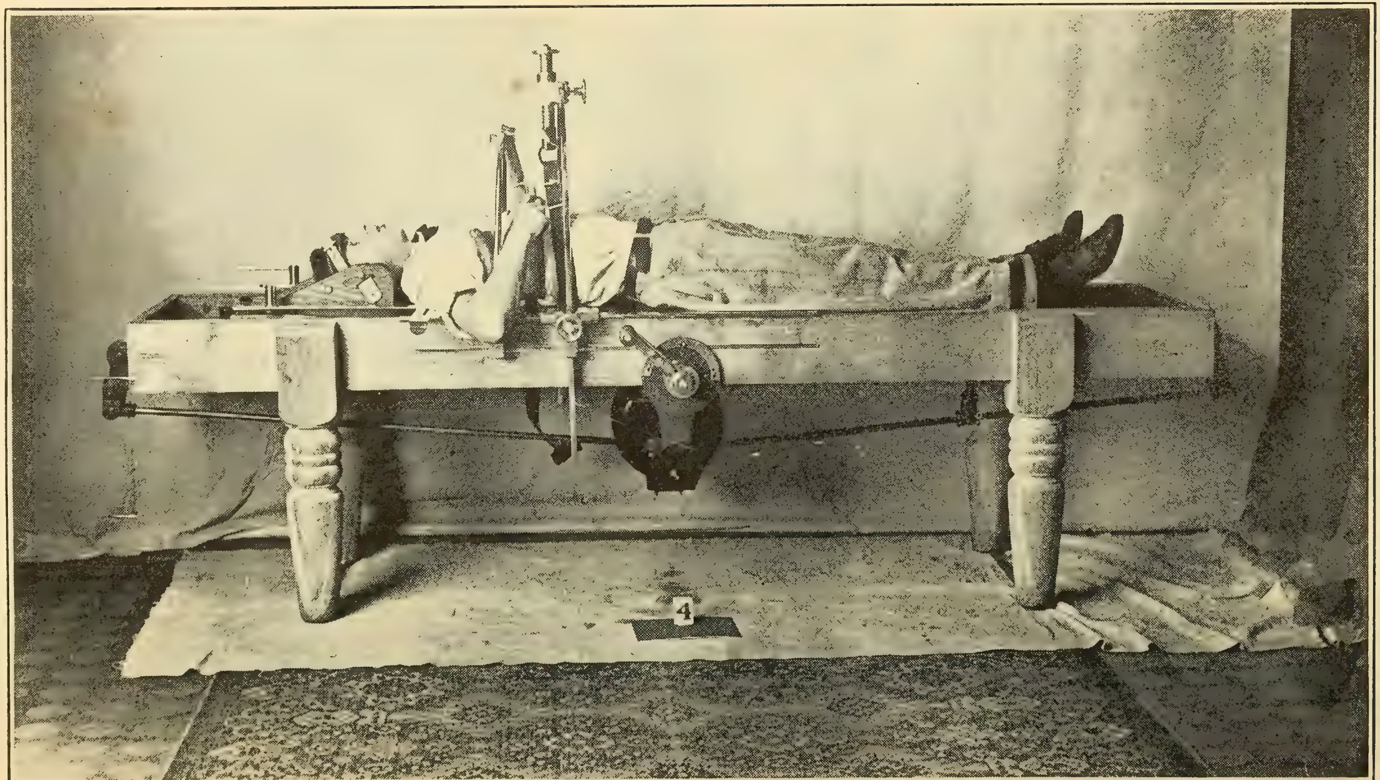
7. Longitudinal Vibration.—Another and more effective method of vibrato-traction may be obtained by an end-to-end vibration, which is produced by a foot and head attachment enabling us to produce the spinal traction. This traction vibration produces a constant moving apart, and then toward each other, of the vertebræ for a fraction of an inch or so, from 500 to 1,500 times per minute. This causes a lengthening and relaxation of the spinal ligaments very rapidly, and produces a decided relaxation of the musculature of the spine and an increase in the height of the patient.

This treatment has also a decided stimulating effect upon the circulation and upon the tonicity of the spinal musculature. This is no doubt the most effective way of overcoming the settling of the spine that takes place as age comes on, and a most stimulating method of treatment that will entirely overcome that tired or exhausted condition after a hard day's work.

The subject of spinal stretching has received much attention and is worthy of much more attention and more constant use by the busy practitioner of rational methods of treatment.

MECHANICAL STRETCHING

Writer's Note.—Although stretching has long been recognized as a part of the indicated treatment of curvatures of the spine, dislocations, and kindred deformities, it is only within the last few years that its wide and general



Amplia thrill for longitudinal vibrato-traction.

therapeutic value has received scientific credence. Likewise all devices for scientifically applying the principle, are of recent invention. Scientific stretching by mechanical means as now widely employed, is essentially a part of the new education in healing, which includes the sciences of chiropractic, osteopathy, mechano-therapy, etc. In the discussion which follows, its use as an assistant to practitioners of all schools is suggested, with the expectation, however, that its most direct appeal will be to the chiropractors. Should this discussion chance to recite some of the philosophy expressed elsewhere in this book, it is because we find that repetition emphasizes the importance of the ideas to be covered.

In the promotion of disease, the derivative influences of pathologically implicated spinal muscles and ligaments are manifold. That through injury or other causes they become hyper- and hypo-toned, i. e., their tonicity is changed, is common knowledge. Abnormal contractures mean a shortening of a muscle or ligament. Hypo-relaxation of any part of the musculature is generally traceable to overcontracture in another part.

As the muscles and ligaments shorten, the segments of the vertebræ are drawn together in too close relation. If the shortening take equal force on all sides of the column, the spine is said to settle. If the tension is greater on one side than on another, the equilibrium of the column is at once disturbed; the vertebræ become unplumb. If the malalignment be slight, we call it a subluxation; if it be great, a curvature. While it is often asserted that in a settled spine the relation of the vertebræ to each other need not be altered, yet this is not true. There should be no doubt but that the slightest settling of the spine tends to change the normal curves of the body.

As the contractured muscles and ligaments draw upon the spinal column, the vertebral bodies are made to compress the fibro-cartilages, whose function it is to maintain a perfect alignment of the column, give elasticity and mobility to it, to act as shock absorbers for the nervous system, and which determine the size, shape and condition of the spinal apertures which are the exits of the nerves and blood vessels as they pass from the spinal

cord, with nourishment for the muscles and organs of the body. The intervertebral cartilages make up about five inches of the column's length, and their importance in the body is out of all proportion to the attention they have received in the literature of the sciences. Having no nerves, no blood vessels, and no lymphatics, they depend for their nourishment upon their ability to absorb and transform, into solid substance, the constant exudations of lymph from the contiguous vessels.

To draw these fluids into the joints of the column where they are consumed by the cartilages, a vacuum-like action in the joint is necessary. In the normal spine, where the freedom of the movements of the joint is not interfered with, the natural movements of the body—the bending forward, backward and sidewise, which our daily activities and exercises call forth, with its alternate stretching and relaxing of the surrounding tissue, produces the required vacuum-like action, and the lymph necessary for the constant rebuilding of the cartilages is readily drawn into its little canals (canaliculi) and there transformed.

As the vertebræ are brought, by contraction of the connective tissue, abnormally close together, they compress these cartilages. The cartilages flatten and the canaliculi are rendered unreceptive to the absorption of the fluids as a sponge under pressure would be to water. The lymph is not taken up by them and we thus get a primary cause of the depletion and destruction of cartilage and its train of derivative evils. Cartilages starve for lack of nourishment as does a muscle or organ of the body whose nerve and blood supply is diminished. Moreover these exudations of lymph remain unused in the surrounding tissues; they stagnate and poison and contribute to many other pathological conditions.

With the flattening of these cartilages, also comes a diminution in size, and change in shape, of the spinal

apertures. The relation of the processes to each other is changed; the current of nerve force and flow of blood from the cord is obstructed; the organs fed by the nerves exiting from the involved joint or joints suffer starvation, and we have disease. Cut off the current entirely, and we have paralysis somewhere. We may get, in a comparatively young person, a condition of "old age," through the general settling of the spine as a result of hypertonicity in the muscles and ligaments. The bones, skin, blood vessels, and muscles all suffer when nerve nourishment is obstructed.

These contractured muscles retard the circulation of blood and lymph. Perfect metabolism and muscular efficiency require that a given amount of these fluids circulate in a given time.

The spinal muscles receive their vascular branches from the same arteries that supply the spinal cord. If circulation within the muscles themselves is retarded the blood supply to the cord is supernormal and congestion is the result, a healthy circulation in the cord being prerequisite to healthy circulation elsewhere in the body.

Manifestly any attempts to permanently cure any of the diseases which result from nerve and blood obstruction, starvation, etc., must consider the primary causes and remove them, before lasting benefits follow.

While no doubt can be expressed, that immediate benefits follow the setting up of "spontaneity" by means of the "thrust," or other hand adjustment upon the involved nerves at their point of exit, yet cartilage regeneration and a restoration of the muscular and ligamentous tonicity are paramount.

Contractures can be most speedily and effectively overcome and a normal tonicity established, by placing the patient upon a flat, and as near hard, surface, as is possible without discomfort. Under these conditions voluntary relaxation is best encouraged. For general

traction, which can be universally employed not only with safety, but with good results, the body should be engaged at the head (occiput and chin, leaving the forehead free), at the axillæ, in most instances, and at the ankles. Where localized stretching is indicated or desired, other engagements can be made. No muscular effort on the part of the patient should be called for in securing the stretch. The traction should be applied steadily and maintained until a complete relaxation of the musculature is secured. Patients soon discover the soporific effects of the stretch and the futility of resistance. They can be depended upon to aid, by voluntarily "letting go." The resiliency of the body is very apt to surpass the expectations of even the physician, unless he has experimented widely.

In a stretch covering several minutes it is constantly necessary to take up the "slack" of the body, following the muscular relaxation and cartilaginous expansion. The amount of traction required, or desirable, cannot be measured by any means whatsoever, save by the attitude and feeling of the patient. Attachments for gauging in pounds the amount of the stretch, and the habit of prescribing a given amount in any given case, have been discarded by all intelligent experimenters. No two cases present the same muscular development, or the same education in relaxation, and no individual case will present the same needs on two consecutive occasions. The individual feelings in each case, at the time of stretching, is the best gauge, and the only scientific prescription is—give all the patients will take without exceeding their resiliency, which will be evidenced by a twitching sensation in the muscles, a feeling of involuntary resistance. This sensation many times serves as an indicator for the length of time the stretch should be continued, as well.

During seven years of wide use, by hundreds of practitioners, no discouraging effects have resulted, and

my personal belief, supported by the opinions of many eminent physicians of the various schools, is, that the more generally stretching is employed in the treatment of both acute and chronic conditions, particularly those of structural origin, the greater will be the success of the practitioner. So much greater tension is required than seems credible to the unacquainted, that we feel justified in discouraging attempts at hand traction, and the use of suspension apparatuses which depend upon the weight of the body to provide the stretch.

If it is to be either scientific or effective it must be maintained for several minutes and applied over a wide area. If applied alike to tensed and relaxed muscles simultaneously, the shortened muscles and ligaments protect the hypo-relaxed or normally toned ones, so that they will be subjected to only sufficient stretch to increase their cellular activity in a way to promote normal development. The fear which is sometimes expressed, of overstretching relaxed muscles, is thus seen to be entirely groundless. The shortened muscles and ligaments must take the burden of the stretch before the normal ones are reached.

The body should be so supported mechanically, at the dorsal curve, that it would be in a scientifically correct standing posture were the machine "upended;" then there is no tendency to reduce the normal curves of the body. The patient is stretched until the cartilages are freed from osseous pressure caused by contractures. These cartilages readily expand under proper influences and, as they do, the vertebræ are forced into normal relation vertically. The spinal apertures are opened, nerves and vessels are freed and we have the food materials at hand for the repair of diseased conditions. Drainage within the muscles is facilitated, waste products and poisonous lymph are forced out, their activity is accelerated, and they are picked up and carried out in the circulatory

channels. The stagnated venous blood too long retained in the tissues surrounding the cord is eliminated and its devitalizing effects overcome.

Traction squeezes the lymph and blood from the capillaries and tissue in the muscle fibers and new tissue is built up. The cartilages freed from compression are rendered receptive to the fluid exudations intended for their nourishment and their regeneration proceeds. While the patient is retained in this state of fixed traction, the chiropractic thrust can be given for specific correction and an added effectiveness attaches to the spontaneity set up in the joints, under these conditions. The hand of the practitioner is relieved of the necessity of combating the resistance of tensed muscles where the stretching preliminary is employed and the vertebræ will be found infinitely more receptive to the thrust. From this it is reasonable to argue that the correction is more accurate, minutely scientific, and less haphazard.

The therapeutic value of retaining the body in this state of fixed traction for a time after hand correction has been made, is obvious. The activity which is set up by the thrust, where the muscles and ligaments have not been brought into a proper state of receptiveness, is diminished and its recuperative and reparative value modified. The steady, vigorous drawing of the muscles and ligaments on all sides of the column, or of a subluxated vertebra, until they are brought out of the contractured condition, through relaxation and again into an artificially tensed state, is a most potent assistant in establishing definite normal alignment. Some exaggerated subluxations which have resisted, successfully, over a period of years, the efforts at hand correction of some of the ablest practitioners, have "snapped" into alignment when placed under the first strenuous mechanical stretch, and a permanent correction has unquestionably been made in several cases, in an instant.

The steady stretch upon both ends of a curved spine, drawing it into a normally straight line, while at the same time retracing the course through which the case has traveled in creating the curvature, overcoming the conditions which contributed to it, is, we believe, the most direct means of correcting curvatures and kindred deformities.

That stretching is a most promising and potent assistant in locomotor ataxia and paralysis is now quite freely admitted, and the claims made for it have been verified in several instances. The belief is that the benefits arising, are due to an increase of activity in the good cells and the consequent derivative influence on the morbid ones.

It is agreed among many of the foremost authorities, that in either the first, second or third stages of locomotor ataxia, seldom, if ever, are all the cells included in the degeneracy, that the sensibility of many of them respond to proper influences. The hope is that through the establishment of functional activity of the nerve cells and trunks, the co-ordinative powers may be restored.

That the cord itself can be stretched and actually extended, cannot be doubted, and the result of this stretching is, we believe, the same as it would be in a muscle. Muscular contraction and relaxation is necessary for the nutrition of the muscle. There is every reason to believe that the stretching of the cord, the nerve filaments and trunks, aids in the removal of lymph and with it the waste products through the promotion of a free circulation, while at the same time the processes of oxidation and repair are enlivened. If we can, as seems certain, increase the activity of the cells in one portion of the cord, the belief that it will have a beneficial derivative influence upon the degenerating cells in other portions is well grounded. The action is similar to massage or

vibration, though penetrating deeper with a consequent greater effect upon the nerve centers.

The same relaxing and contracting effects in the muscular walls can be secured through stretching, as through exercise of other forms, at the same time the increased circulation is distributed over so wide an area of the body and under such conditions of freedom as to relieve the heart of the customary labors following other forms of exercise.

The most we can hope to do in the space of a single chapter is to suggest uses for stretching. We have endeavored here to point out a few specific uses such as will cause the practitioner to put his mind onto the idea, knowing that needs for such assistive agents will suggest themselves in numbers.

By David Bertram Cropp. Formerly of the Faculty of the University of Colorado and Dakota University. Inventor of the Stretcher, the Traction Couch, and other Devices for Mechanically Stretching the Body.

The illustration on page 413 shows the patient lying face upward upon the stretcher, engaged at the head, shoulders, and ankles. The body at the dorsal curve is supported on spring crutches connected by a wide leather strap. This support serves the double purpose of holding the body of the patient in a correct posture, prohibiting too great stretch against the curve of the body at that point, and forces the shoulder blades in in such manner as to stretch the intercostal muscles and cartilages, elevating the chest walls, enlarging their dimensions so that greater freedom for the vital organs is established.

This illustration shows the patient receiving direct traction, valuable in so wide a range of cases. When it is desirable to make specific hand adjustment of the vertebrae, the patient can be placed face downward upon the machine, leaving the entire spinal area exposed. A detachable cushion mounted on coil springs with a wood base, and one bridging cushion aid materially in giving adjustment while the body is tensed. These are supplied with the machine here shown.

CHAPTER II.

MASSEURING.

MASSAGE has been extensively used for many, many years. It is a popular method of treatment, and there is no doubt that masseurs accomplish much good; otherwise people would not support the profession.

Massage has a positive and decided action upon the physical condition and the functional activity of the peripheral and accessible portions of the body, and reflexly, a decided influence upon the internal physical and functional conditions.

Some writers enumerate a few of the principal effects of massage in the following manner:

1. Increases the secretions.
2. Lessens visceral congestion.
3. Stimulates automatic reflexes.
4. Lightens the work of the heart.
5. Assists the peripheral circulation.
6. Causes breaking up of adhesions of joints.
7. Produces exudation and stimulates absorption.

1. Increases the Secretions.—Massage increases the secretions of all the glandular organs of the body. Those glandular tissues that are situated in accessible regions so that they may be influenced by massage, are stimulated mechanically, and also by influence upon the nervous system, by stimulating the peripheral afferent nerve endings.

The deep glands that cannot be mechanically stimulated because of their inaccessibility, are stimulated reflexly through the influence of massage upon the peripheral system.

2. Lessens Visceral Congestion.—Massage, by

determining the blood to the peripheral portions of the body, relieves the internal congestion of the viscera of the trunk. Massage, either active or passive, by means of special exercises, is very helpful and conducive to health by relieving visceral congestion and stagnation, and by promoting a flow of the blood to the peripheral muscles and extremities.

3. Stimulates Automatic Reflexes.—The terminal afferent filaments of the nervous system, and especially the gray rami of the sympathetic system, are stimulated by peripheral manipulation, as massage; consequently reflex response is stimulated, and all of the automatic action of the nervous system is increased, and a general tonic effect is produced.

4. Lightens the Work of the Heart.—Massage increases the circulation of the periphery of the body, and in this way causes an equalization of the circulation throughout the entire body, and this greatly lessens the work done by the heart, inasmuch as the heart's work is to maintain an equalization of the central and peripheral circulation.

We find an evidence of this fact in fasts. When a patient is fasting, there is no internal or visceral congestion produced by the process of digestion; consequently the work of the heart is greatly diminished or reduced to the minimum.

On the other hand, many people, with weak hearts, have died of heart failure shortly after eating a hearty meal. Internal congestion produced by the effort of the internal viscera to take care of the food stuff, has thrown too much strain upon the heart, which was laboring to maintain an equalization of the circulation at the time of death.

5. Assists the Peripheral Circulation.—Active or passive action of the muscles causes much more blood to

be determined into them and mechanically aids the movements of the contents of the vascular system.

Active exercise causes an increase in the amount of blood in the peripheral muscular tissues of the body.

Massage which produces passive exercise of the muscles, will determine an excessive amount of blood into the peripheral muscular tissues of the body or the parts that are manipulated.

6. Cause of Breaking Up of Adhesions.—The ligaments and tendons of joints, because of deposits within them, and the consequent irritation, seem bound by innumerable minor adhesions, preventing free movements of the joints, and, in fact, all movement without pain.

Massage helps in exudation and absorption, and increases the circulation and tends to break up the adhesions slowly, and for this reason it is a very helpful procedure on parts or joints of this nature. If, however, there is an infection and a process of germ development, then the massage may cause an absorption of the toxins produced by the germs.

Sometimes constitutional symptoms are in this way produced, the principal of which is elevation of temperature. An elevation of temperature following massage is because pathognomonic germ toxins are generated in the tissues of the joint, which are absorbed into the general circulation and which stimulate the action of the thermogenetic nerve centers.

7. Promotes Exudation and Stimulates Absorption.—Massage increases all glandular activity, as stated above, whether the glands are accessible to the mechanical influence of massage, or whether they are affected by the reflex stimulation through the sympathetic nervous system. All glandular exudation and absorption is thereby increased, also the exudation of the muscular tissues, because of the mechanical stimulation produced

by manipulation, will be increased, and the absorption of the necessary nutrient elements, and even of pathological exudates, will be generally increased for the same reason.

In the above remarks we have referred principally to a general massage, but the more important effects of massage are produced by manipulations along the spinal column.

Dowse observes that "ten minutes' massage of the spine will increase the volume of the pulse and the temperature, generally, more than one hour's work at the body as a whole, the spine being omitted."

In massage of the spinal musculature, we stimulate the nerves at their spinal origin, and have a decided action upon their peripheral functional activity. In massage of the spinal column, we are working directly upon the nerves that ramify all portions of the body at their spinal origin. Because of this concentration of our manipulation at the origin of the nerve supply, we are enabled to affect all parts of the body by manipulating a small portion thereof, viz., the spinal column.

Marion Edward Clark, D. O., observes in his excellent work on Applied Anatomy: "It does little if any good to treat the effects—that is, to try to relax or contract the muscles by direct manipulation of them, unless there is a structural shortening, since their condition is the effect. Adjust the vertebra, and the effect will disappear."

Direct manipulation of the musculature of the spine is no doubt conducive to a relaxation thereof, and thereby in a measure, in a mild way, relieves contraction and interference with the nerve supply. In other words, it relieves the cause, that the effect may disappear.

We will say, however, in this connection, that massage is a very slow and ineffectual way of relieving contractions of the musculature of the spinal column, compared with the specific thrust to stretch and relax the muscula-

ture of any contractured portion, thereby relieving the nerve.

We enumerate some of the different methods of procedure that we embrace under the art of masseuring, as follows:

1. Flexing.
2. Tapping.
3. Swaying.
4. Friction.
5. Stroking.
6. Kneading.
7. Springing.

1. Flexing.—We can do flexing of the spine by having the patient sit in a chair with one of the operator's hands on the back of head and the other against the chest. In this way we can flex the upper portion of the thoracic region. Now, again, the patient may sit on the floor, the legs extended straight and bent forward, while the operator produces a pressure on the back of the head which will flex the entire spine and stretch the sciatic nerves.

2. Tapping.—Tapping may be done with the end of the fingers, with the palm of the hand, or with the ulnar border of the hands. The tapping is more stimulating to the deeper tissues and to the nerves than is friction.

3. Swaying.—Swaying of the spine may be done by using a table especially prepared for such work. The way we have our up-to-date adjusting table built, the spine may be swayed from side to side, thus loosening up some of the non-used ligaments and tendons of the spine, which sometimes is very helpful in case of the deposit of uric acid or urates in the slightly used muscles or tissues of the spine. This is a very great assistance to us in gaining that flexibility and suppleness of the spine that is so necessary to the circulation and healthful condition thereof.

Swaying may be done by the patient sitting on a stool, and supporting the head on the arm, while a lateral movement or pressure in the thoracic region or even in the lumbar region, which is made with one hand of the doctor, while his other hand holds the supporting arm of the patient's head. Swaying may also be accomplished while the patient lies prone on the operating table, by catching the opposite lower limb about the knee with one hand, and pulling it toward the side on which the operator stands, while the pisiform bone of the other hand presses against the spinous processes of the lumbar vertebræ, pushing them from the operator. This movement may be applied to either side, and to any spinous processes from the first to the fifth lumbar, and this will greatly assist in relaxing the lateral ligaments of the lumbar region.

4. Friction.—Friction is sometimes used to stimulate the skin action and capillary circulation. It is sometimes used on the point of irritation, in which case it may act as a counter-irritant. It is sometimes used immediately after a thrust is given to nullify the painful temporary effects or muscular spasm caused by the thrust.

5. Stroking.—Stroking is a palliative method that is used simply to allay an excitable condition of the peripheral endings of the afferent nerves in the superficial tissues of the spine and to stimulate the internal abdominal viscera by external stroking upon the abdominal surface.

6. Kneading.—Kneading is used to a considerable extent by some practitioners who work upon the spine. Deep kneading is very effective sometimes in stimulating the circulation and relaxing contracted ligaments along the spinal column, and is very palliative and sometimes effective in doing great good.

7. Springing.—We find springing of the spine, like swaying, helps to produce flexibility of the spinal column.

The patient should lie upon the chest, being also supported in the pelvic region, while the back is being sprung down at different parts or segments until we produce the flexibility that is so very much desired.

III. Concussion.—Concussion is a very important method of procedure in spondylotherapeutic methods.

We may relieve all interference with the nerve sheath by relaxing any of the musculature of the spinal column which is contractured, and any narrowing of the foramen through which it passes from the neural canal by spinal adjustment. We may, by removing interference with the nerve sheath, open the conducting paths of all nerve impulses, and remove all occlusion of the vascular system, and thus restore normal nutrition and normal drainage. We may, in this way, restore the normal impulse of the nerve supply.

There is no doubt that when we remove interference with the nerve supply, that the very act of removing the pressure from the nerve will stimulate and excite an increased action. This, however, is temporary in effect, and in time we cease to have anything above the normal functional activity of the nerve supply from these sources.

By concussion we can do more, provided the concussion is done in connection with measures that overcome interference with the nerve supply. Concussion of the spine will stimulate the roots of origin of the motor efferent nerves.

Concussion may be applied continuously for several minutes, and decided stimulation of the motor efferent nerves may be produced and continued. There are cases in which we want more than the normal nerve supply to restore a normal condition, owing to the extent of the pathological lesions.

The conditions may be such that the normal impulse is not sufficient to restore the normal condition. In such

cases, an increase, or an excessive nerve impulse or nerve activity, may accomplish what the normal nerve action will not accomplish; hence concussion, used as an auxiliary method, is an important agency, stimulating the nerve action, and thus becomes a very important means of restoring the normal conditions in tissues supplied.

Spinal nerves are responsible for all the function in all the tissues of the body. They exert an influence upon the glandular secretions, upon the metabolic processes, upon thermogenesis, and also control thermic regulation. They control the motor influences of the muscular tissues, and vasomotor influences over the vessels of the circulation.

The vasomotor influences control vasoconstriction and vasodilation of the blood vessels. When we stimulate the spinal centers, we may intensify the phenomena described above. As indicated, we may, by relieving the nerve of all interference, obtain the normal impulse and normal functional activity; we may be able to enhance the impulses beyond the normal, but concussion is a wonderful aid to still further stimulate and increase the different phenomena of nerve function.

It is necessary that we understand the centers which control the vasoconstriction and vasodilation, and also the condition of the muscular tone of the different viscera of the body, before giving treatment.

Concussion, without sufficient knowledge, may be very detrimental. For example: We may produce vasodilation when we should produce vasoconstriction, and *vice versa*. In case of hemorrhage of the lungs we would produce vasoconstriction in order to check the hemorrhage. Now if we were not familiar with the different spinal reflexes, we might, by stimulation of the vasoconstrictor and also the vasodilator centers, produce no perceptible effect. The excitation produced in such

cases would nullify each other. We might even stimulate the vasodilator, when we wish to stimulate the vasoconstrictor action. In this case, we would have exactly the reverse effect to what we desire to produce. We had a patient come to us two weeks since and he was having a continuous but light hemorrhage from the lungs continuing for nearly three weeks. We, by using the concussion stroke vibrator over the fourth and fifth cervical vertebræ, entirely stopped the spitting of blood. After two weeks, while writing this, the patient returned greatly improved from the two treatments we gave him.

In the case of aortic or abdominal aneurism or dilatation of the heart, we should have a thorough knowledge of the vasoconstrictor centers if we would excite a vasoconstrictor influence upon these organs. We should never stimulate the vasodilator centers for the reason that we would nullify the beneficial effects of stimulation of the vasoconstrictor centers. Or, in case we did not stimulate the vasoconstrictor centers, then by a stimulation of the vasodilator centers we would produce a very unfavorable result.

Dr. Albert Abrams, of San Francisco, Cal., has furnished some very valuable information as to the location of the spinal reflexes, and we are pleased to acknowledge full credit to him for a great deal of the information that we have been able to acquire concerning this subject. From personal experience we want to heartily endorse what he has laid down, and we have thoroughly tested this matter in our clinical work during the last year or two. We have been able to accomplish some very wonderful results by a combination of the chiropractic spondylotherapy method and by concussion of the spinal column over relative spinal centers.

By adjustment, we are enabled to open up the channels for the transmission of nerve impulse. By concussion we are able to increase these impulses, and for these reasons

we feel that we have had a much greater success by a combination of the two methods of spondylotherapy, than we could have had by either alone. This matter will be taken up and considered again in the Methods of Adjustment in subsequent chapters.

IV. SISMOTHERAPY.—Sismotherapy, or vibrato-therapy, is a method of treatment that is used on different parts of the body, but in spondylotherapy it is used almost exclusively in the treatment of the musculature of the spinal column.

This method of treatment is a very excellent auxiliary to other methods of spinal treatment. The effects obtained by use of the vibrator depend, to a great extent, upon the nature of the stroke of the vibrator that is used. If the lateral or rotary movement is applied to the spine, or to either side thereof, we will have produced thereby a mechanical massage. This mechanical massage may only affect the peripheral tissues, but by pressure, the deeper tissues may be influenced.

This vibratory massage movement stimulates the circulation of the blood and lymphatics, and has a tendency to relax muscles and tendons; in fact, many of the results of manual massage may be equaled, or perhaps exceeded by mechanical massage produced by the use of the vibrator. It is quite effective, often, in the relief of pain.

In the case of aged people with contractured conditions of the musculature of the spinal column, the vibrator is good, and an effective way of relieving that contracted condition. It is a palliative treatment that is preparatory to a favorable condition of adjustment, and, on the other hand, it is a treatment that will prevent soreness which follows spinal adjustment.

The vibrator is also useful as a means of promoting the absorption of the by-products of digestion, such as

uric acid, etc., and, like massage, it may be used to advantage in these conditions.

In sismotherapy we may use a vibrator that has a direct straight concussion stroke instead of a massage or lateral or rotary movement. The concussion stroke is decidedly more effective as mechanical stimuli to the nerves and spinal centers, and we get an entirely different action from stimulating the spinal nerves at their exit, or at the origin of their roots in the spinal column, by vibration or concussion, than we do by adjustment. By the vibrator we get a mechanical stimulation of the centers, depending upon the length, force, and rapidity of the stroke. It is estimated that at least three strokes per second are necessary to excite any stimulation of any consequence, and that ten strokes per second will excite almost or quite the maximum stimulation. In fact, more rapidity of the rate of vibration than ten strokes per minute does not produce proportionately greater excitation.

It is well to remember that concussion and stimulation of certain spinal centers will produce vasoconstrictor action upon the vessels and viscera of the trunk, while concussion or hammer stroke upon other segments of the spine will produce vasodilator effects upon the vessels and viscera.

Now if all the centers of the spine are stimulated alike, we have a confusion of results. The effect of the stimulation of one center will counteract the effects of the stimulation of the center that will produce the opposite effect, hence, it is necessary to understand the spinal centers and their specific influence as to motor, vasodilator and vasoconstrictor influence upon the vascular system, and the viscera of the trunk before presuming to give concussion stimulation to the spine.

We have fortunately been able to find a vibrator that gives the concussion stroke and it has proven very

effective. We have used a mallet made of rubber, as a plexor, and a pleximeter of rubber. By manual concussion in this way, we have produced some very satisfactory results.

We have been able to strengthen the heart beat, and inhibit the rate thereof, and we believe that the vibrator that we use that gives the pure simple concussion stroke of sufficient length, strength and rapidity, is a much more practical instrument in the hand of the well-educated than any ordinary vibrator, and is much more effective than manual concussion.

We have experienced difficulty in securing an outfit for our concussion stimulation of spinal centers, as it is difficult to secure an outfit that would do the work satisfactorily, and that would not be too expensive. We are glad that we have been able to find a satisfactory outfit run by electric current and at a very reasonable price. After months of use with this outfit we are satisfied with it in every way.

CHAPTER III.

THERMOTHERAPY.

THERMOTHERAPY, like sismotherapy, may be used to produce local effects on any part of the body.

Thermotherapy consists of the application of heat. The action of a hot application in spinal treatment is confined almost exclusively to the spinal column, but thermotherapy may be used as a peripheral application to affect the local circulation, and also to influence the reflex action of any portion of the body.

The effect of a hot application is stimulating, the duration of the continuation of the stimulation depending upon the intensity of the heat. A mild application of heat exerts a stimulating effect continuously, while a sufficiently hot stimulant may soon destroy the sensibility and the histological condition of the part to which the heat is applied.

Hot applications determine blood to the local zone to which they are applied, and thereby produce a hyperæmic condition. They also hasten the circulation of the blood and increase the flow in the lymphatic channels.

When a hot application is made to any portion of the spine for the purpose of stimulation, the above conditions of stimulation and hyperæmia are induced in the spinal segment, in that portion of the spine that is stimulated by the hot applications.

Hot applications will often relieve pain and uneasiness if the application is properly regulated, as to the temperature, and the number and length of the time of the application.

The application of heat has primarily a decided stimulating effect, and the first differs materially from the

secondary effect, in vasomotor influence and action. The primary effect of a hot application produces vasodilation in the local zone to which the heat is applied, and consequently there is a reddened or hyperæmic condition. A long continued application of heat will produce a chronic contraction of the vascular channels of the zone to which it is applied, and will, for this reason, produce a pale, white, and anæmic appearance because of the induced anæmic condition.

We may wish to produce and to maintain the primary effect without inducing the secondary. We may wish to produce a hyperæmic condition of a certain segment of the spinal column, and to continue that effect for some time without inducing the secondary and anæmic effect.

In order to prevent the secondary vasoconstrictor effect of the hot applications, we find it necessary to alternate from the hot to the cold applications frequently. The primary effect of the heat will last from about three to five minutes, when the secondary effect begins to ensue.

If we alternate and apply a cold application at the conclusion of about four minutes of the application of heat, we will for the time reverse the conditions induced by the heat, and will induce a rush of blood supply in response to the vasoexciting influences of the cold application. This will enhance the effects of the hot application in the way of determining the liquid elements to the local zone.

When the heat is again applied, again we have vasostimulating effects produced, and another increase of the hyperæmic condition of the part. The cold application should be applied only about one minute. This alteration of the temperature of the application, not only maintains a hyperæmic condition, but the effects of the application of the heat will be greatly enhanced because of the changes from one extreme of temperature to

another, and the consequent increased excitation or stimulation.

Heat applied to a warm surface will not stimulate as much as heat applied to a cold surface, and if the surface is made cold by an application, then the heat will produce a much more decided effect. So it is always well to observe the rules outlined below in the application of heat to produce a hyperæmic condition, namely: Apply the hot application for four minutes, and then the cold application from one half to one minute. A repetition of from about four to six applications of heat of about four minutes each and this followed each time by cold application for one half to one minute, is usually sufficient to relieve ordinary pains, and when applied to the spine to produce decided therapeutic effects.

A practical way of using thermotherapy is to do so by using flannel cloths about the size of one fourth of an ordinary single bed blanket. One piece should be folded and dipped in boiling water, the ends being kept dry, then, by twisting, the water can be wrung from it fairly well. The other piece of blanket should be placed over the zone to which the heat is to be applied. The blanket wrung from the hot water should then be placed over the dry one, and the ends of the dry blanket used to inclose and maintain the heat of the hot blanket. A very high temperature can be applied in this way. There will be enough dampness in the way of steam to make the heat moist, and this is far superior to heat from a light, as is often used in spinal treatment.

Ice may be used as a convenient method of applying the cold alternating applications after the extremes of heat. The ice is not at all disagreeable after a hot application; in fact, patients often claim that the sensation is pleasant.

Another method of applying thermotherapy is by the use of the thermophore. This is a pad that may be made

any desirable size, that is placed over the local zone, while the end of the cord is attached to the electric socket. This is very convenient for the application of heat to a local zone. It is also very convenient to apply the cold at intervals, which may be done by simply raising the hot pad and passing the ice underneath it.

After the local zone is chilled for a minute or half a minute, the pad may be replaced to the part. The exchanging of the hot and cold applications in this way is a very convenient matter.

Still another method of thermotherapy is practiced by means of therapeutic lamps. Heat is applied to any zone in this way. Heat may be applied along the spinal column also. The difference in the color of the light applied will produce different effects upon the local zone to which it is applied. We may cause vasoconstriction or vasodilation by difference in color used, in the application of therapeutic rays.

Thermotherapy directly applied to the spinal column will accomplish more in fifteen to twenty minutes than the hot applications to other portions of the body will accomplish in an hour. Not only are the effects much more readily produced, but they are much more decided when applied to the spinal centers than when applied to the peripheral portions of the body. In one case we stimulate the roots of origin of the nerves; while in the other we get the reflex influence only.

So, for constitutional and general effects, the hot fomentations, the thermophore or the therapeutic light, will have a much more decided effect when applied directly to the spinal column where we may affect the spinal centers.

VI. PSYCHROTHERAPY.—Psychrotherapy in the practice of spondylotherapy consists of cold applications and of cold freezing mixtures usually applied to and

expected to affect the spinal nerves at, or near, their spinal exit.

The object of the application of the cold is for the relief of pain, which is produced as a result of the continuation of the application of cold. Applications of cold are also applied to other parts of the body for the purpose of producing reflex influences, but in spinal treatment the application of cold is confined more directly to segments of the spinal column and usually for alternating effects.

The primary effect of the cold application is stimulation, unless we should have a failure of reaction against the application. The stimulation is proportionate to the amount of reaction against the application of the cold.

Placing the hands in cold water will cause an immediate reaction, a congested condition, and an increased local thermogenesis will immediately ensue. This is well known to the laity, who are accustomed to dashing their hands in cold water to relieve them of a frost-bitten condition.

The stimulating effects of cold applications are not so transient as might be supposed. A cold application increases heat production.

General applications to the body increase the tonicity and thermogenesis of the entire body. The cold sponge bath is an excellent preventive against general colds, which may be produced by the changes of the weather, provided the skin is inactive and weak in power of reaction.

The farmer who runs around the house in his bare feet in the snow in the morning and then dries the snow from his feet and puts on his shoes, will ordinarily have feet comfortably warm the whole day long.

The skin's activity is practically what we educate it to be, and there are agencies that will stimulate reaction against the changes of the weather, such as the brief

applications of cold, hence the skin should be educated to react against the sudden changes in weather by brief exposures to cold applications.

It is the exciting effects of the application of cold that makes it useful in spondylotherapy. If the cold is needed as a sedative application, it should not be applied continually for a long time. A long continuation of the application of cold will temporarily paralyze the zone or part to which it is applied.

We may, however, continue the application of cold, or even ice, for a considerable time if we will take the pains to alternate the cold applications with hot applications. For example, if we apply the cold four minutes then we may apply the hot one minute. The hot application not only overcomes the temporary condition produced by the cold application, but prevents complete paralysis, as would ordinarily be produced by the continued application of cold, and this will also greatly enhance the beneficial effects of the cold application. This is due to the fact that one reaction after another against the application of the cold may be brought on by repeated changes from the hot to the cold applications.

One question that may arise, is: Which is best to apply to a patient, the hot or the cold application? This question, the feeling of the patient will answer. Always make the application that relieves or is most palliative to the patient's feeling. As a rule, a close adherence to this principle will always guide us aright.

Heat, like cold, applied to the spine, produces a decided excitation and stimulation of the spinal centers. The application of cold has also been employed for the relief of pain by the continued application of freezing mixtures, or by the application of ice to the origin of the spinal nerves. Sometimes clear distilled water has been injected into the tissues, and then by means of a freezing mixture, has been converted into ice, which allays the

pain and deadens the sensibilities, and produces a paralysis of the nerve which is affected by this freezing for the relief of pain.

We do not feel that this is a wise plan to pursue. Pain is simply the interpretation of an impulse conducted usually by a live and often healthful nerve. We should not paralyze that nerve which tells the story, but rather relieve the mechanical interference and obstruction that interferes with the integrity of that nerve, causing the pain. This can be done in practically all cases almost immediately by spinal adjustment.

A cold application to the back of the neck will produce a vasoconstrictor influence of the vessels in the region of the cranial nerves. This measure has been taken advantage of often by the laity, who have learned that by placing a cold pack to the back of the neck, they may control nose bleeding.

The cold pack is also frequently used for the relief of inflammatory conditions in rheumatic joints. In this case, the application is usually made around the joint itself, instead of being applied to the spine to excite nerve centers. The most common use that we make of the cold application in spondylotherapy, is the use of it as an alternating application when we are applying hot applications to the spine.

Nerve Pressure.—Nerve pressure may be applied to any part of a nerve in its course, but in spondylotherapy it is usually applied to nerves near their spinal origin from the neural canal of the spinal column or along their track of distribution, if that track is accessible.

Nerve pressure will allay the irritation, and also relieve the tenderness of a nerve, and often by this method pain is readily relieved.

We find often that after tracing a tender nerve, and having palpated it from the spine perhaps to a peripheral zone, that the pain will entirely disappear, and thus it

would appear, that from mere pressure upon the nerve, while palpating, that the tenderness and pain are entirely relieved, and for this reason we are led to believe that this would be an important auxiliary method of spinal treatment.

Such an auxiliary method would be especially useful in the treatment of a patient with a very tender condition of the spine. In some patients in which there is considerable contracture of the musculature of the spine, an adjustment is almost an impossibility, and where the nerve is very tender, an instantaneous shock of pain will be produced by the thrust, and also soreness will be produced because of injury to the fibrillæ of the spinal tissues.

Milder methods, such as swaying, massage, nerve-pressure, and vibration, may, in such cases, be employed to good advantage. Not only is it more agreeable to the patient, but more conducive to good in many cases. These remedies, while they are reducing the spine to a normal condition, and removing the tenderness so we can really adjust, will also allay an irritable condition of the nerve and improve its function.

We certainly feel it a mistake on the part of many who practice spinal adjustment, that they are not broad enough in their ideas. They see but one way of doing anything for a patient, and will fail to be successful for that reason in many cases, especially old persons. There are others more considerate of the needs and conditions of their patients, and they are also more resourceful and handle their patients more successfully and reach cases that others fail to satisfy.

We have had some very successful experience in the administration of nerve pressure as an auxiliary method of treatment on several occasions, and for this reason we feel anxious to urge this matter upon all practitioners using spondylotherapy methods.

A patient called at the writer's office suffering with tic douloureux. He complained that he had suffered almost constantly for three weeks. He held his hands cupped, and declared he had taken as much as the two hands full of medicine, but had received no relief, except a temporary effect from the use of anodynes.

We made a careful examination, feeling sure that the cause of the tic douloureux, which was toward the outer side of the right orbital region, was the result of some interference with the upper cervical nerves. We located a nerve emerging from the spine, and found it to be extremely tender when palpated. We traced this nerve from the cervical region segment step by step to the zone of the pain. This nerve seemed to be somewhat less tender the further we traced it, and by the time we reached the location of the pain, the patient declared he had no pain whatever. It was either pressure upon the nerve or imagination that cured his pain.

We took the precaution, however, to relieve the contraction in the neck that was causing interference with the nerve, to prevent any return of the pain. The tic douloureux disappeared and did not return. Not only was this a great victory for spinal adjustment, but it signified quite emphatically the importance of palpating nerves, and the application of pressure upon them for relief of pain.

One other very important case, and example of nerve pressure as an auxiliary method in spinal treatment, was the case of a little girl who was taken ill very suddenly with spinal meningitis. The writer was called to the child soon after the attack, and found the spinal column exceedingly tender. Not thinking of meningitis, we decided that it was owing to some injury to the spine sustained while playing with children. A mild treatment was given; some hot applications were recommended

to be applied to the spine, and we judged that the child would soon recover.

The next day we had a hurried call to go to the child, who lived six miles distant. When we arrived, we found the child apparently breathing its last. The parents and friends were grouped around the bedside, and the child lay with head drawn back; the child had a very high fever with an occasional tremor running over its body apparently as if breathing its last at each respiration. We confidently believed the child would not have lived even ten minutes without relief.

We began by nerve pressure between the transverse processes to those regions of the spine which seemed to be most involved; in fact, we applied some nerve pressure to all portions of the spinal column from the upper cervical to the lower lumbar, inclusive. In twenty minutes' time the child was decidedly relieved, and was regaining consciousness. In less than an hour, we left the bedside of the child, but it had recovered sufficiently to be conscious and to ask questions, and to assure the friends and parents that it was not suffering with any pain whatever. It seemed wholly relieved. The child also soon asked for nourishment. An assistant was sent who worked with the child some more that afternoon. The treatment was kept up for three days, when the case was dismissed as being out of danger.

During the entire treatment not one single spinal adjustment was given. Nerve pressure was depended upon, together with some hot and cold applications. The recovery was rapid, and no sequelæ ensued, and we considered the case remarkable and a great victory for rational spondylotherapy methods.

In conclusion, we might enumerate the office equipment necessary in the practice of spondylotherapy methods, as outlined above:

1. Thermophore.
2. Portable table.
3. Stretching table.
4. Adjustment table.
5. Urinalysis outfit.
6. Electric vibrator.
7. Percussion apparatus.

The urinalysis outfit mentioned above is especially to be recommended because of its diagnostic importance. We have been able to relieve albuminuria, glycosuria, and diabetes mellitus in a number of cases.

When such work is accomplished by spondylotherapy methods, it is hard to make a disbelieving people believe it. We want all the positive evidence at our command to be brought to bear in all such cases.

A careful urinalysis will first give us a correct idea of the abnormal function of the kidneys. A subsequent urinalysis, giving negative results, will give positive evidence of the efficacy of our treatment, and such evidence as will convince the most skeptical. We should also send specimens of the urine to some known and reliable laboratory and the laboratory analysis will corroborate our work.

CHAPTER IV.

ATLAS METHODS.

ADJUSTMENT of the spine means, literally, to procure therein a normal condition, and freedom from all interference with the spinal nerve supply which may result from spinal lesions.

If lesions are produced as a result of contraction of the musculature of the spine, then adjustment means simply a relaxation of the spinal ligaments, thereby overcoming the contraction.

Any undue approximation of vertebra is due, usually, to contraction of the musculature of the spine, or to a settling of the spine, and a consequent thinning of the intervertebral cartilages. If we relax the spinal ligaments and separate the articular surfaces which have been approximated, then there is a tendency on the part of the intervertebral cartilaginous discs to expand and overcome the thinned condition into which they have been forced by long-continued compression.

When the writer at first made a study of the subject of adjustment, it was under teachers whose idea of subluxation was that a vertebra had slipped out of its place from some cause and that an adjustment was for the purpose of pushing it back to where it belonged. We were further taught that a vertebra would perhaps remain as we adjusted it for an hour or so after being thrust into its normal position. After continued adjustment, the vertebra, it was claimed, would remain in place longer each time, until finally the vertebra would permanently stay where it belonged.

We were further taught that a person turning in bed was liable to slip a vertebra out of its place. We were also taught that this slipping of a vertebra out of place

would not occur all at one time, but would occur partially each time a person turned over, until it remained entirely and permanently out of place.

Then, according to this, the adjustment is the act of thrusting a vertebra back to where it belongs until a repetition of this procedure, from day to day, causes the vertebra to remain where it belonged.

At the present we are glad to feel that we have advanced far ahead of the teaching we received along this line from our first preceptors in spinal adjustment. The idea of a vertebra slipping out of place will never appeal to thinking and intelligent people. Such a theory as we were taught, would never be believed nor taught by a man of thorough education and competent understanding of anatomy.

The real fact, as believed by educated men who have made a study of this subject, is, that it is a settling of the spine or a contraction of its musculature, that approximate vertebræ narrow the intervertebral foramina, and cause nerve interference, as outlined in a previous chapter on the causes of spinal lesions.

We have also made considerable advancement in gaining a knowledge of better methods of relieving spinal lesions or conditions which are called subluxation of the spinal column or vertebræ. It is only after investigating and determining for ourselves the above information concerning the cause and relief of spinal lesions, that we are enabled to fully appreciate the true philosophy and importance of the science of chiropractic spondylotherapy.

We were not long in finding that the methods of adjustment which were first taught us, were as crude as were the theories we were taught. By travel, by study, and by visiting with others, we have succeeded in learning many better ways of loosening up the con-

tracted musculature of the spinal column and overcoming interference with the spinal nerves.

Many American practitioners of chiropractic and osteopathic spondylotherapy have succeeded in developing many improved methods of adjustment. We have been successful in learning a little and picking up a method of adjustment here and there, and have made efforts to obtain all the possible information we could that we might raise the standard and efficiency of spinal adjustment.

We have made a study of the methods used in Bohemia, the country from which some crude methods of adjustment were first introduced into this country. We find that the Bohemians in their native country, who are now better posted in the practice of spinal adjustment, use many excellent methods of adjustment that their countrymen, uneducated in this line, did not introduce into this country, probably from the lack of competent knowledge concerning this matter. The American practitioners have added some excellent manipulations which are very useful methods of spinal adjustment.

We have spared neither time nor expense in obtaining all the information we know to be possible, and since so doing, we are giving you in this volume many new and better American methods of adjustment as well as the many excellent methods of the Bohemians, which so far are unknown except to a few on the American continent.

At the present time we are giving in the neighborhood of fifty-five methods of spinal adjustment, whereas when we first began the work of chiropractic spondylotherapy we had been taught but three methods of adjustment, we have found by experience that there was much room for advancement from the limited knowledge of this science possessed by our first teacher.

In our study of the methods of spinal adjustment, we find it convenient to study the peculiar methods especially

effective in each of the different segments of the spine. We divide the spine into the following divisions:

I. Atlas methods.
II. Cervical methods.
III. Upper thoracic methods.
IV. General thoracic methods.
V. The general lumbar methods.
VI. Special fifth lumbar methods.
VII. General spinal adjustment methods.

I. Atlas Methods.—We now use and teach eleven methods of atlas adjustment. We will enumerate these methods of adjustment under the following heads:

1. Old method.
2. Bimanual method.
3. Transverse method.
4. Finger pivot method.
5. Knuckle thrust method.
6. Bimanual thrust method.
7. Mento-occipital thrust method.
8. Mento-occipital rotary method sitting.
9. Mento-occipital rotary method pronate.
10. Mento-occipital rotary method dorsal.
11. The transverse anterior thrust method.

1. The Old Method. (See Illustration, page 441.)—This is a method of adjustment of a patient's atlas while he is lying prone upon the adjustment table.

The method of procedure in giving this adjustment may be described as follows:

Position.—The patient should lie prone upon the adjustment table. Face may be turned to either side.

First. The face of the patient is turned towards the operator, adjuster standing on the patient's left side.

The ulnar border or pisiform bone of the left hand is placed upon the lamina of the posterior arch and transverse process of the atlas, hugging close to the occipital bone.

Atlas adjustment (old method).

The fingers are extended round the back portion of the neck.

The right hand supports and strengthens the left.

The thrust is given at an angle of about 45 degrees downward and from the operator. This thrust opens the occipito-atlantal articulation on the opposite side.

By reversing the head or direction of the face and by changing the hands so as to use the ulnar border of the right hand on the side of the posterior arch of the atlas, the opposite side of the occipito-atlantal articulation may be opened. This method is quite uncomfortable, unpleasant, and while effective in some cases there are other methods that are more effectual and much less disagreeable and less uncomfortable to the patient, and for this reason we seldom use this method since learning so many better ones.

2. Bimanual Method. Atlas Method. (See Illustration, page 443.)—The contact of the bimanual with ulnar border of the hand on transverse process. This method is practically painless and a very easy method in which a person may easily become proficient.

Position.—Have patient lie on adjustment table in the prone position while the operator stands at the head.

Support the head on one hand while the other hand is used to give the thrust. Apply the ulnar border or pisiform behind the transverse process of the atlas.

If the atlas is to be adjusted and the articulation opened on the left side, then place the ulnar border of the right hand in contact with the transverse process of the atlas while the head is rotated, the chin of the patient toward his left shoulder and supported by the left hand.

Give thrust against transverse with the right hand and thrust the head upward with the left hand and make the thrust with each hand simultaneously and have the direction of the movement of the two hands in directly opposite directions. This will easily move the atlas or

Bimanual atlas method.

open the articulation on the opposite side to which the thrust is given. To open up the articulation on the opposite or right side, rotate patient's chin to the right and the occiput to the left shoulder. Rest the patient's left cheek upon your right hand and thrust with the left hand on the transverse process of the atlas upon the left side.

The same contact and movement may be used in making an adjustment of the axis, third or fourth cervical vertebra.

A simple test for the purpose of determining if the occipito-atlantal articulation is normal, is to have the patient look directly overhead. The patient should stand with the feet placed flat upon the floor, while the neck is flexed back so as to look directly overhead. If there is no interference with this movement in any way, then the atlas articulates properly with the occipital bone, and there can be no subluxation of it unless there be a uniform contraction and approximation of the atlas on both sides with the occipital bone, then the movement will not be normally free, but limited.

3. Transverse Method. (See Illustration, page 445.)—This is a very simple and easy method, and in this way an adjustment or an opening up of the occipito-atlantal articulation may be very easily accomplished.

The technique of the method may be described as follows:

Position.—The patient sits on a chair or stool while the operator stands behind.

When we desire to open the occipito-atlantal articulation upon the right side, stand behind the right shoulder of the patient.

Extend the right hand around the neck of the patient on the right side until the contact finger reaches the transverse process of the atlas upon the left side.

Place the fingers of the right hand behind the trans-

Transverse atlas method.

verse processes of the atlas on the left side of the neck close against the occipital bone.

Place your left hand against the right side of the patient's head.

Flex the head over the finger that is holding the transverse process of the atlas.

When the head is flexed as far as possible, and when there is no further resistance, a thrust is given to the transverse process of the atlas which will loosen up the articulation on the right side when the pressure is made, as it is in this case, upon the transverse process of the left side of the atlas.

When the finger is pressed against the atlas, and when the head is flexed as far as it will, we may sometimes obtain a complete relaxation by a slight movement of the head, before giving the thrust.

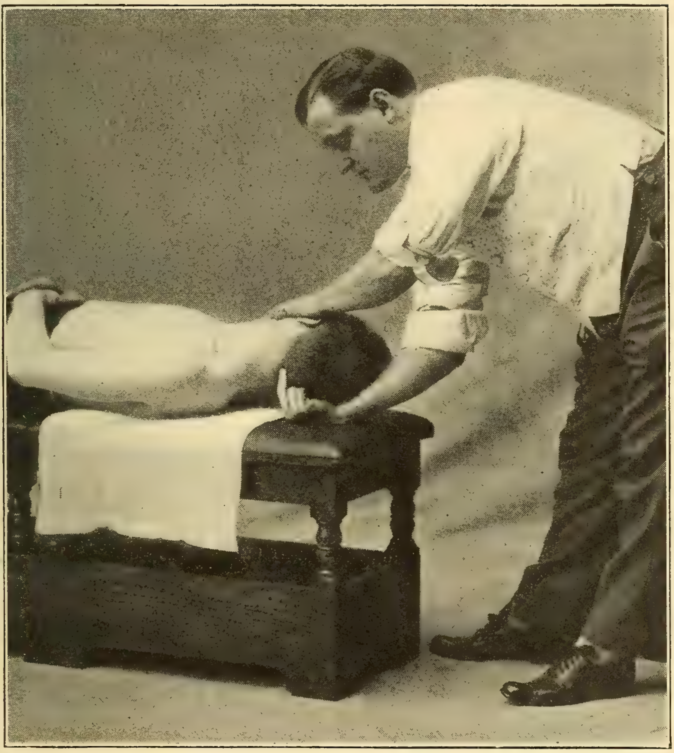
The thrust is given almost wholly with the finger that is pressed against the transverse process of the atlas, while the other hand is used to maintain the flexion and to steady the head, but no thrust should be given with the supporting hand against the side of the head.

If we wish to loosen up the occipito-atlantal articulation on the left side, then the operator should stand behind the left shoulder of the patient.

Extend the left hand around the neck in front and catch the transverse process of the atlas on the right side of the neck with the middle or index finger.

Use the right hand against the left side of the head to support it and flex it over the middle finger of the left hand which is supporting the right transverse process of the atlas.

When complete flexion and relaxation is obtained, the thrust may be given with the middle finger of the left hand to the right transverse process of the atlas, in this way the left side of the occipito-atlantal articulation may be loosened. This is an excellent method of atlas



Finger pivot atlas method.

adjustment and may be also used upon the other cervical vertebræ in making adjustment.

4. Finger Pivot Method. (See Illustration, page 447.)—This is a very effective method of loosening up the occipito-atlantal articulation, and it is a method that we frequently use in our work of spinal adjustment.

Position.—The patient should lie upon his back upon the adjustment table, while the operator stands at the head of the patient.

The face of the patient may be turned to the right or to the left and the fingers of the corresponding hand of the operator used as the pivot.

If the face is turned to the right, then the tips of the middle and ring fingers of the right hand are placed against the lamina of the atlas upon the right and inferior side.

These fingers should be flexed at right angles with the hand, while the back of the hand rests upon the table. In this way we get a solid support and consequently a permanent pivot for the atlas and head.

The contact of the supporting fingers to the lamina of the atlas should be as near the posterior border of the neck, or to the posterior portion of the arch of the atlas, as possible.

The left hand then is placed upon the chin of the patient.

The head should then be rotated, the chin to the right, at the same time the lamina of the atlas should be supported by the fingers of the right hand underneath.

When the rotation is as far as the head will move then a slight movement following a slight relaxation will open the occipito-atlantal articulation on the opposite side to the support given to the lamina of the atlas; this is done very easily and effectively The landmark for finding the laminæ of the atlas is the point about

half way between the inferior prominence of the mastoid cells and the spinous process of the axis.

This method is a very excellent one, and far superior to the methods described above, and for this reason we consider it one of our best methods of atlas adjustment.

5. Knuckle Thrust Method.—This is a thrust applied to the front of the transverse processes of the atlas, and may be given by folding the fingers and by placing the knuckles in the inner space between the inferior maxillary bone and the transverse process of the atlas upon either side of the neck.

A thrust is then given with the knuckles of the bent finger to the front of the transverse processes as the patient lies upon the back; this movement tends to correct a forward condition of the atlas. A better contact in giving this adjustment is to place the pisiform bone against the transverse process of the atlas.

This is not a very practical method of adjustment, for the reason that the knuckles or point of contact will too often press upon the nerves, and the thrust will be painful. The pressure of the folded fingers cannot be gotten directly in contact with the front of the transverse process of the atlas without using considerable caution. This method, however, is quite effective in some subluxations in which a transverse process of the atlas is anterior, when it is desired to thrust it backward into its proper position. The pisiform portion of the ulnar border of the hand may be used instead of the knuckles, and this is a better contact and consequently a better way to make this adjustment.

6. Bimanual Thrust Method. (See Illustration, page 450.)—This is an easy method that may in some cases be used advantageously.

Position.—The patient lies prone upon the adjustment table, while the adjuster stands to one side.

Head may be turned on either side of the face, first,

and then rotated to the other direction for adjustment on the other side of the atlas.

One hand catches the occiput of the patient's head while the other hand is in contact with the side of the face that is up.

A sudden thrust is then given to the occiput and side of face simultaneously, that thrusts the head away from its close articulation with the atlas.

This is one of the most easily executed and most accurate adjustments that can be made—with the patient

lying either upon the back, or prone upon the face. This adjustment is especially to be recommended, because, if properly given, there is practically no pain felt by the patient; also, this adjustment has this advantage: You may, by applying the greatest force to the occipital bone, throw the head forward and loosen the posterior part of the occipito-atlantal articulation, as is often necessary in case of approximation of the posterior arch of the atlas to the occipital bone. You can, by applying the most force to the side of the face, elevate the forward part of the cranium, thus separating the anterior arch of the atlas from the occipital bone.

7. Mento-occipito Thrust Method.—This method of atlas adjustment is simple, effective and painless.

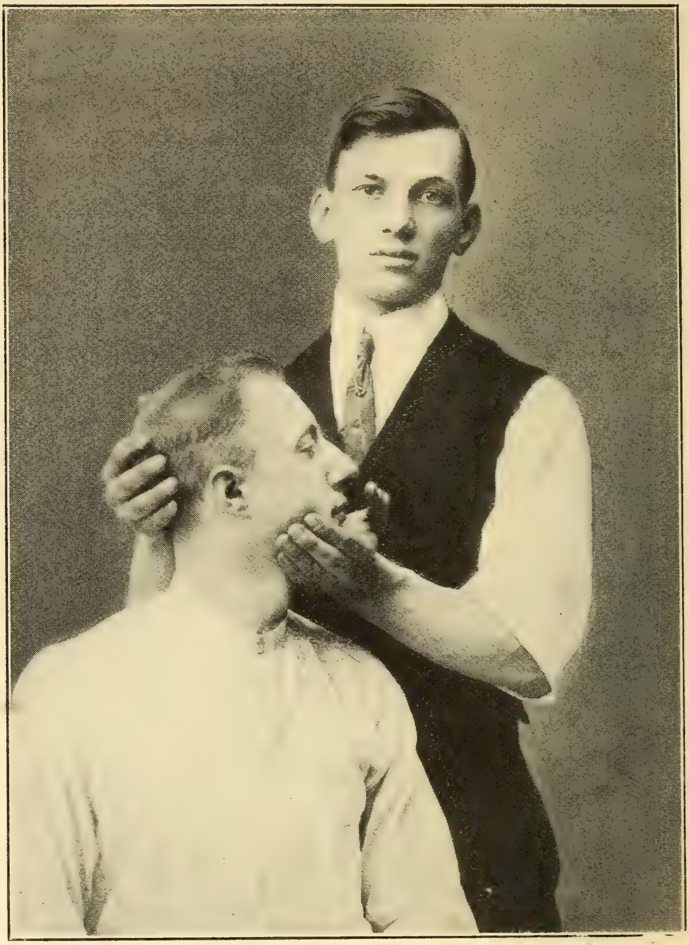
Position.—The patient lies in a prone position with the face turned to one or the other side. The operator, standing at the side of the patient, catches the occiput with one hand and with the other hand catches the patient's chin.

The head is pushed from the body, producing a tension upon the patient's neck.

A thrusting of the head away from the cervical vertebræ will loosen up the occipito-atlantal articulation upon the same side to which the pressure is applied.

This method is useful because of the fact that it is painless; it also has one more advantage, which is as follows: When giving the thrust with the two hands, the most of the force of it may be applied to either the chin or to the occiput, as may be desired, and in this way we may effect either a backward or forward movement of the atlas.

By reversing the head, turning the face in the opposite direction, the thrust may be applied to the other side of the head and thus loosen up the other side of the occipito-atlantal.



Mento-occipital rotary method (sitting) √

8. Mento-occipital Rotary Method. Sitting Posture. (See Illustration, page 452.)—This is a very convenient method of adjustment, as it may be used anywhere and at any time for the reason that it is a convenient method of procedure in any position.

Position.—The patient may sit on a chair or a stool or on the floor, while the operator stands behind.

With one hand, catch the occiput, while the other hand catches the chin.

Standing behind the patient's right shoulder the left hand supports the occiput, while the left hand catches the chin.

The head is then raised both back and front, producing a gentle traction or tension upon the cervical musculature which will loosen up the vertebral articulations of the cervical region to a certain extent.

The head is then rotated, the chin to the right, the occiput to the left, as far as it will rotate conveniently.

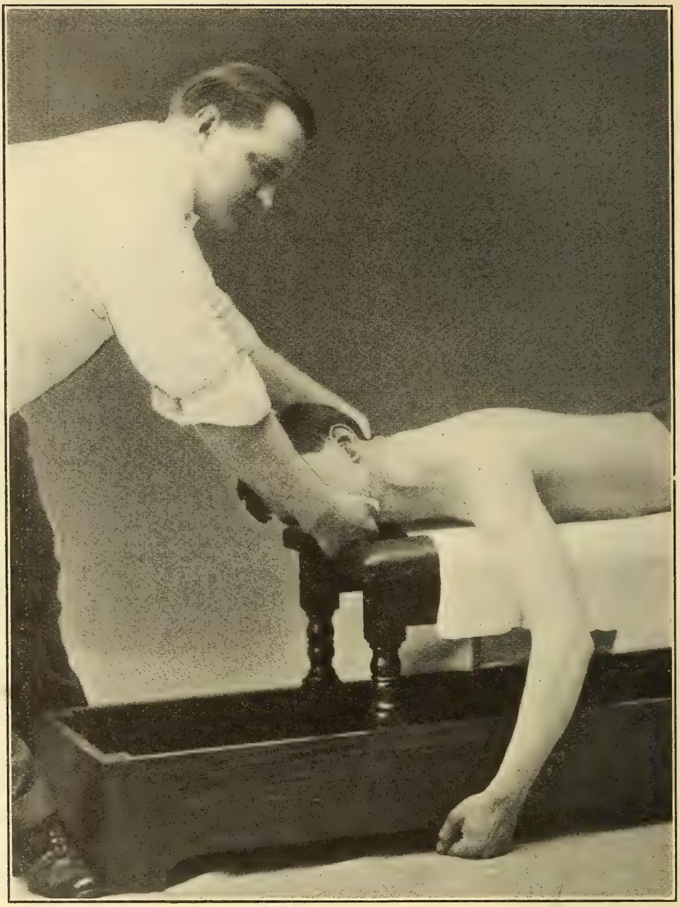
At the limit of the rotation, after first relaxing partially, a quick movement will open up the articulation between the atlas and occipital bone upon one side with comparative ease.

By reversing the above procedure, using the left hand to catch the chin, with the left arm upon the left side of the patient's neck while the right hand supports the occipital bone, the head may be rotated in the opposite direction and the occipito-atlantal articulation may be loosened up on the opposite side.

This is a fairly good and convenient method, and may be used anywhere effectively, and in a general way is preferable to the old or beefy method.

Practically the same principle is used in the following positions which we describe, the principal difference being changes in the technique in the changed positions.

9. Mento-occipital Rotary Pronate Position. (See Illustration, page 454.)—This is a very effective and



Mento-occipital rotary (pronate).

easy way of loosening up the occipito-atlantal articulation while the patient lies upon the face.

Position.—The patient lies prone upon the table, while the operator stands at the head.

One hand is used to catch the chin, while the other supports the occiput, but in a reverse manner to what is used in the mento-occipital adjustment in the sitting, or upright position.

We will suppose that the patient lies with the head turned so as to rest the right side of the face upon the table.

Then we would catch the chin of the patient with the right hand, and the occiput with the left, and we rotate the occiput toward the right shoulder of the patient, and the chin toward the left.

Extension should be made at the same time we make the rotation. If the extension is of proper amount, and the rotation is sufficient, the adjustment is made with comparative ease.

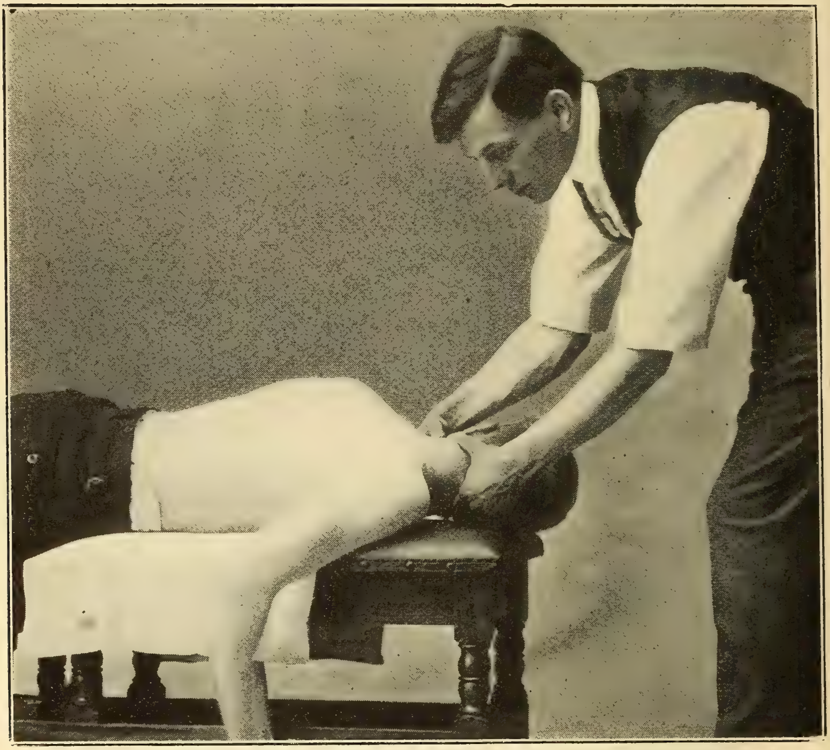
When the head is rotated as far as it will, conveniently, a slight relaxation should be made, and then a quick movement with comparatively little force will loosen up the articulation between the atlas and occiput.

By reversing the face of the patient to the opposite side, and by changing hands and reversing the rotation, we are enabled to loosen up the articulation of the opposite side.

10. Mento-occipital Rotary (Dorsal Position). (See Illustration, page 456.)—This is made similar to the finger pivot method, but varies in the fact that the hand under the head and supporting it does not rest upon the table.

Position.—The patient lies upon the back of the adjustment table, while the operator stands at the head.

One hand is caught under the chin and the other under the occiput, and the head is pulled toward the



Mento-occipital rotary (dorsal position).

operator, extending the neck, and in this condition the rotation and the movement will effectually and easily loosen up the occipito-atlantal articulations.

If the right hand holds the chin of the patient and extends on the right side of the face, and the left hand holds the occiput, then the chin should be rotated toward the left shoulder of the patient.

If the opposite side also needs loosening up, then the hands should be changed.

Extend the left hand on the left side of the face and catch the chin, and with the right hand catch the occiput, and then by rotating the chin to the right, we may easily accomplish the desired adjustment.

This method is a fairly convenient way, and is sometimes used after adjusting the lower cervical vertebræ by means of the Ely method of adjustment, as the patient already lies in the right position for this method.

11. Transverse Anterior Thrust Method. (See Illustration, page 458).—This may be used in case of an anterior subluxation of the transverse process of the atlas and axis. It is not a favorable method because of the difficulty of obtaining a proper contact without infringing upon the integrity of cervical nerves and causing pain and discomfort.

The patient lies upon his back upon the adjustment table, the operator stands at the head of the patient.

To illustrate, we will suppose that the left transverse process of the atlas is anterior.

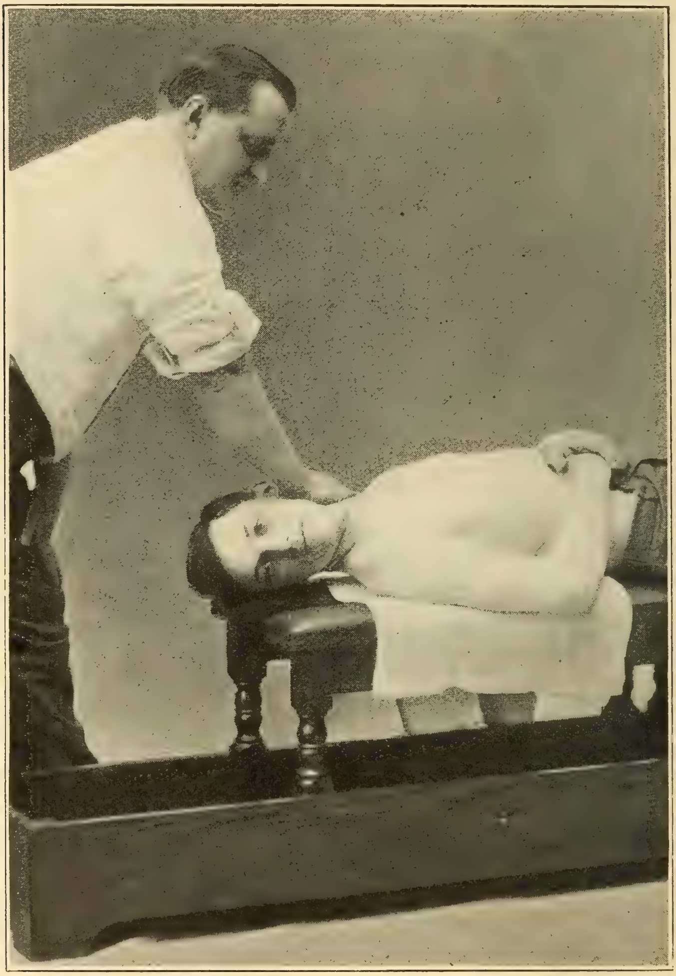
Have the patient turn the head and lie upon the right side of the face.

This rotation of the head brings the left transverse process of the atlas to the upper side of the head and neck and directly into the field of operation.

The pisiform bone of the operator's right hand is then placed in contact with the transverse process of the atlas.

Be careful in obtaining a contact that is not painful to the patient.

The direction of the thrust should be backward and downward. This is a method that is seldom used.



Transverse anterior thrust method.

CHAPTER V.

CERVICAL METHODS.

WE will, in this chapter, consider a number of methods of procedure that have been and are used, in loosening up the articulations between the cervical vertebræ. Many different methods have been used, and each and every one of the methods seem to possess some advantages in certain cases owing to the many different circumstances under which adjustment may be given. We will describe several methods which we enumerate as follows, and which we feel to be efficient:

1. The old method.
2. The T. M. method.
3. The rotary method.
4. The flexed finger method.
5. The centrum thrust method.
6. The bimanual thrust method.
7. The transverse process method.
8. The transverse process rotary method.
9. The spinous and transverse process method.

In the above enumeration the names do not clearly indicate the nature of the method, but in the following discussion we hope to make the different methods clear and comprehensive.

1. The Old Method. (See Illustration, page 441.)—By the old method we refer to the first method that was used in America and the first method learned and used by the writer, but we are confident that this method was originated in this country, being a cruder method than was used by the Bohemians trained in spinal adjustment. The use of this method in America is due to the fact that the persons introducing the methods of spinal

adjustment in this country, had but a vague idea of the methods used in Bohemia, and other places where better methods had been evolved. The method consists of the following technique:

The patient lies upon the table in a prone position.

The operator standing on the left side of the patient, should have the patient's face turned toward him.

Apply the ulnar border or pisiform bone to the side of the neck to the processes of the vertebræ.

The force of the thrust is directed against both the transverse and spinous processes of the vertebræ.

The thrust is given downward, and the direction is slightly backward at an angle of something like 45 degrees down and from the operator.

In order to loosen up the articulations of the cervical vertebræ on the opposite side, the face is turned to the other side. The operator may stand on the same side, or step to the other side.

The right hand is used by placing the ulnar border or pisiform bone in contact with the processes of the cervical vertebræ.

The left hand is used to reinforce, and the thrust is given to this side the same as to the other side.

Ordinarily, in adjusting in this manner, one thrust is given to the top of the neck, affecting the atlas or axis.

A second thrust is given to the center of the cervical region, affecting the third, fourth, and fifth cervical vertebræ. A third thrust is given to the lower portion of the cervical region to the sixth and seventh cervical vertebræ. This is repeated on the other side in the same manner to loosen up the articulations of the opposite side to which the thrusts are given.

This method, in a crude way, loosens up the articulations of the cervical region, but there is nothing specific about it, and it is very uncomfortable, and probably the

T M. cervical method.

most painful way of giving adjustments in the cervical region.

We used this method almost exclusively for a long time, until we found that the instruction we had received in this science was very inefficient, and until we learned that there were many better methods that were and might and should be used in preference.

2. THE T. M. METHOD. (See Illustration, page 461.)—By T. M. method is meant the thumb movement method, but when we consider the technique of the movement, the name falls short of expressing its nature.

The movement is given while the patient sits erect on a chair or a stool of ordinary height.

The operator stands behind the patient.

The thumb is placed firmly against the spinous process of the cervical vertebra which is to be supported.

The other hand is placed in contact with the opposite side of the head, and the head is flexed over the contact thumb.

While the patient relaxes, a side movement is given that will loosen up the articulation between the vertebra which has its spinous process supported, and the adjacent vertebra above.

This method should be given with great caution to prevent straining of the ligaments, causing soreness and contractions that may cause trouble.

First, the head should be flexed as far as possible, and the thrust should be given lightly when at about the limit of the normal flexion.

If the head is moved too far, when making the thrust, and in this way gains too much momentum, before it comes to the limit of normal flexion, the force of momentum may be of such an extent as to strain or injure the ligaments attaching the vertebræ. Should there be too much strain, then trouble may be produced. For the

Rotary method.

above reason, many who practice spinal adjustment do not use the T. M. movement.

Probably the vertebræ which may be best adjusted by the T. M. method, are the sixth and seventh cervical and first thoracic.

This method may also be used in adjustment of the first and second thoracic vertebræ. We sometimes can loosen up articulations in this region most successfully with the T. M. movement.

3. The Rotary Method. (See Illustration, page 463.)—This method we first learned of, and it is used almost exclusively in connection with our school work in Oklahoma City and by those trained at this college. It is a method that produces some advantageous results under certain conditions, and it is an effective way of loosening up the articulations from the fourth cervical, down to and including the second thoracic vertebræ. The method is as follows:

The patient remains in a sitting position on a bench or chair.

The operator should stand behind the patient clutching the chin of the patient.

The head is dropped as far as possible with the chin upon the patient's chest.

The thumb of one hand of the adjuster is placed against the spinous process of the vertebra that should remain stationary immediately below the articulation which is to be opened up.

The other hand extends on the opposite side of the neck, and catches the chin of the patient.

While the spinous process is supported by the thumb, and while the head is flexed, the chin is rotated, turning the occiput to the side that is supported by the thumb.

This is a very effective way of loosening up the articulation immediately above the vertebra which has its spinous process supported.

Flexed finger method.

By reversing the hands, and by supporting the spinous process on the opposite side, and catching the chin and rotating it in the opposite direction, we will be able to open up the articulation on the opposite side of the neck.

This method has an important advantage in one respect: When the head is flexed, the spinous processes of the lower cervical vertebræ are separated so that they may be easily distinguished and palpated, and for this reason we may know exactly what vertebra we are adjusting.

This method also gives a good leverage to the operator, so the articulations may easily be loosened up.

In the technique of the above, we might specify more closely, by stating that if the thumb of the left hand is used to support the spinous process, the thumb should be placed against the left side of the spinous process, while the right hand extends on the right side of the neck and catches the chin with the finger upon the left side.

Then the chin is drawn to the right, while the occiput rotates to the left.

The spinous process is forced in the opposite direction.

In this way, we have the rotary loosening up of the articulation between the supported vertebra and the one immediately above.

4. Flexed Finger Method. (See Illustration, page 465.)—In using the fingers flexed in applying a thrust, we find some advantages:

(a) Because of the width of the surface of contact of the adjuster's hand.

(b) Because of a straddling of the prominence of the processes with the fingers.

The fingers are flexed, and the middle phalangeal bones or portions of the finger, form the surface of contact.

The upper portions of the surface of contact should

Centrum thrust method.

be placed against the vertebra which it is desired to adjust, with relation to the one immediately above it.

The thrust is given to the transverse and spinous processes.

The operator may stand on either side of the patient while the patient lies in a prone position.

The patient's face may be turned in either direction, while the thrust is given.

It is an effective method, and will often open up two or three articulations at one time. It is a method that gives us some advantages, but one that we seldom use.

5. Centrum Thrust Method. (See Illustration, page 467.)—We may, by palpating the centrums of the cervical vertebræ, find an unevenness because of a forward protuberance of one or more of them.

To palpate the centrums of the cervical vertebræ, it is best to press the fingers in front of the sterno-mastoid muscles into the soft tissues of the neck, when the centrums of the vertebræ may be easily palpated.

If there is any prominence of a centrum, either forward or lateral, it will be easily detected.

The best method of correcting such a lesion is to place the ulnar border of the hand against the prominence of the centrum.

Then, when standing on the opposite side of the patient, with the head resting against the body, a thrust is given by drawing the prominent centrum toward you.

This is practically a very painless and effective method of reducing such subluxations and evening up the anterior surfaces of the centrums of the cervical vertebræ.

6. Bimanual Thrust Method. (See Illustration, page 499.)

Position.—The patient lies in a prone position on the adjusting table with face lying toward one or the other side. The position of the operator is at the side of the patient's body.

Contact.—The thumb of one hand is placed against the spinous process, on the side opposite to which it should be adjusted.

The occiput of the patient is turned towards the side on which the contact with the thumb is made.

The other hand is placed on the occiput of the patient thus making the spinous and occipital contact.

Suppose we are wanting to throw the spinous process of the fifth, sixth, or seventh cervical vertebræ toward the right:

Doctor's Position.—We may stand to the left side of the adjustment table and patient, or on the right side, or astride the patient.

Patient preferably lies with his face to the side opposite the operator and with the occiput of the head toward the operator.

With the thumb of the left hand we support the fifth, sixth, or seventh spinous process upon the left side.

The right hand is placed upon the occiput of the patient.

The slack is all taken out by a rotary movement rotating the occiput to the left and the spinous process which is supported toward the right.

A slight thrust now in the two directions in which we are rotating the spinous process and the occiput will easily accomplish the desired adjustment.

If the spinous process of a lower cervical vertebra is to the right side instead of the left, and we wish to throw it towards the left to bring it into normal alignment, then we reverse our hold.

We use the thumb of the right hand against the right side of the spinous process of the vertebra to be adjusted, or the one just below it.

The left hand then should be placed in contact with the occiput.

The head in this case is turned to the right, while the face is turned toward the operator.

Rotate sufficient to overcome all slackness and at the same time we support the spinous process of the vertebra with the thumb of the right hand; this will cause a loosening up of the articulation between the vertebra whose spinous process is supported and the one immediately above it. This is a very easy and effective way and much superior to that used by the ordinary practitioners or teachers of spinal adjustment.

Instead of using the thumb against the spinous process of the vertebra to be adjusted, we may use the pisiform bone as a point of contact against the transverse process; in this case the point of contact is changed from the thumb to the pisiform bone and to the ulnar border of the hand.

The pisiform bone contact may be made upon the transverse process in the middle and upper cervical regions in making adjustment.

Position.—The patient lies on the left side of the head, with the face to the left and from the operator.

The operator places the left hand with the pisiform bone in contact with the transverse processes of the cervical vertebræ.

The operator's right hand catches the head or occiput and rotates sufficiently to overcome the slack and then by a slight thrust we may make the desired adjustment.

7. Transverse Process Method. (See Illustration, page 471.)—This is a simple and easy method, and one that works with comparative ease.

The operator stands behind the patient, who sits on a bench or chair.

When you desire to open up the occipito-atlantal articulation on the right side, stand behind the right shoulder of the patient.

Let the right hand extend around the neck on the

Transverse process method.

right side, catching the middle finger upon the transverse processes of the cervical vertebræ.

Place the left hand against the side of the head, and flex the head over the finger that is against the transverse processes.

When the head is flexed as far as it will, and when there is no resistance, a thrust to the transverse processes of these vertebræ will loosen up the articulation on the right side when the thrust is given, as it is in this case, upon the transverse processes on the left side of the neck.

To loosen up the left side, stand behind the patient's left shoulder, extending the left hand around the neck, and catching the transverse processes of the cervical vertebræ with the middle finger.

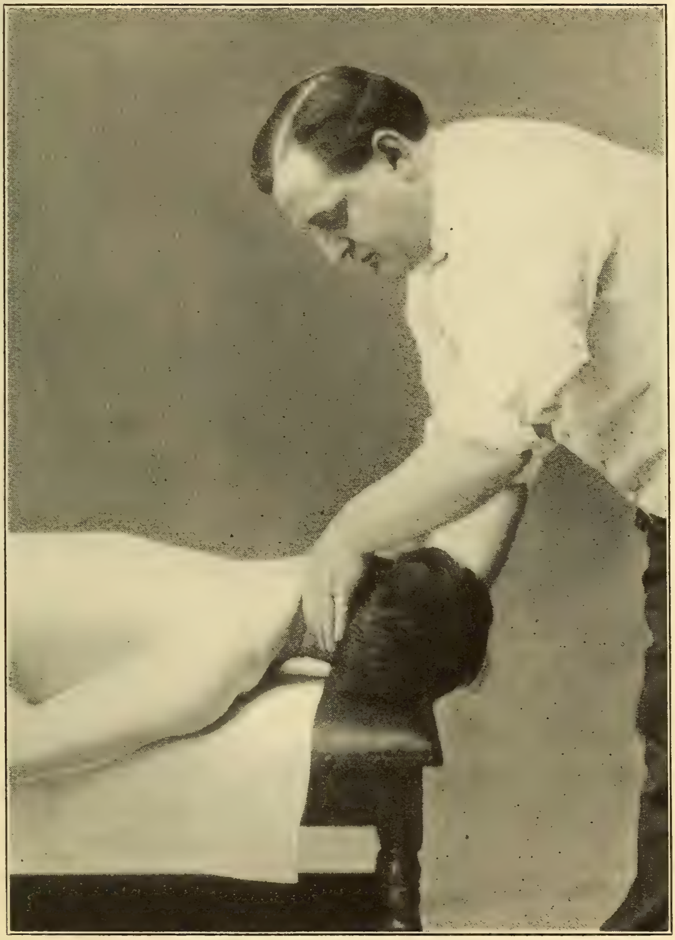
Use the right hand to flex the head over the middle finger of the left hand, and when flexion is complete, the thrust may be given, and in this way the other side of the occipito-atlantal articulation may be opened.

8. TRANSVERSE PROCESS. ROTARY METHOD. (See Illustration, page 473.)—This method, or one very similar, is generally known as the Ely movement, and is one of our best methods of cervical adjustment. It is practically a painless method. The technique is as follows:

The patient lies on the back on the adjusting table, while the operator stands at the patient's head.

The head is raised by the operator, who palpates the tips of the spinous processes of the cervical vertebræ. Any lateral deviation from a normal alignment is readily detected, as the spinous processes are separated by the forward flexed position of the head, and are easily distinguished in palpating. Any lateral condition of a spinous process that is found, is treated as follows:

For example, suppose we find that the spinous process of a vertebra is prominent on the right side. Then a finger of the right hand is held against the prominence of the spinous process.



Transverse process. Rotary method.

The forefinger of the left hand is placed against the tip of the finger that is first placed and held against the spinous prominence.

The head is rotated with the chin to the right over the right hand, while the forefinger of the left hand is brought by a circular movement in contact with the transverse process of the vertebra to be adjusted.

Slight tension is made upon the neck, and a thrust downward and forward is given that tends to rotate the vertebra upon its axis.

This rotary movement tends to throw the spinous process into perfect alignment.

This procedure may be reversed, and the vertebra may be rotated in the opposite direction, always observing the rule to apply the thrust to the transverse process on the opposite side to the prominence of the spinous process that is detected.

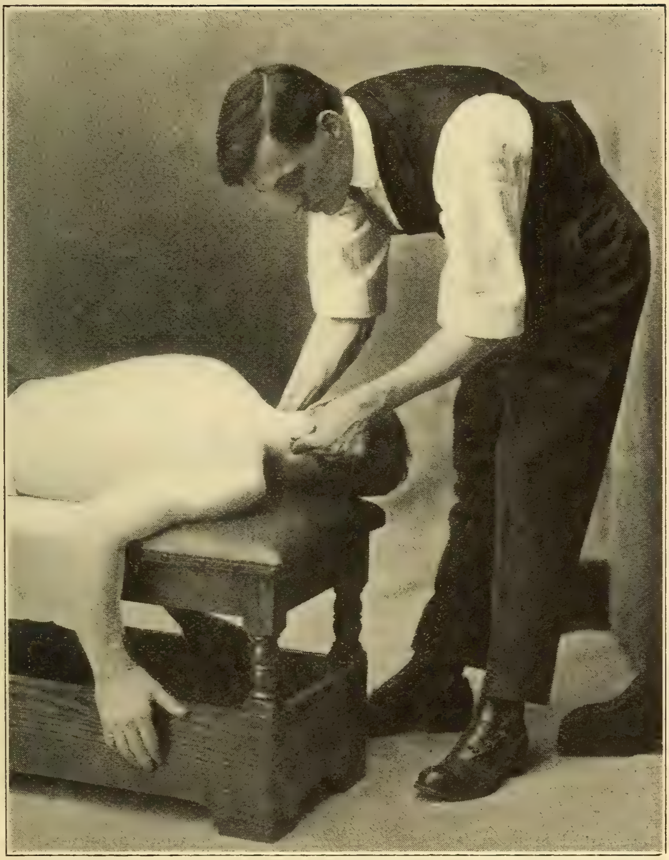
This is one of the most scientific and most perfect methods of adjusting, into perfect alignment, the processes of the cervical vertebræ, that we have ever used in our work. We have obtained some wonderful results by this procedure, and the beauty of it is that the vertebra can be adjusted in this way practically without any pain or discomfort to the patient.

9. Spinous and Transverse Process Method. (See Illustration, page 475.)—This method is an effective way of easily loosening up the cervical vertebræ in the central portion of the cervical region. The technique of this method is as follows:

The patient lies in a prone position upon the adjustment table, while the operator stands at the head of the patient.

If the patient's face is turned to the left and rests upon the right cheek, the operator then catches the chin with the right hand.

With the thumb and forefinger of the left hand, he



Spinous and transverse method.

obtains a contact against the lower inferior side of the spinous and transverse processes of the vertebra below the one he wishes to adjust. This contact will support the vertebra, while a rotation of the head by pulling the chin upward by a movement of the hand which holds it, will loosen the articulation immediately above the vertebra which is supported.

This is a very effective method of adjustment, and the adjacent articulations may be positively and decidedly loosened up in this way.

The operation may be reversed by turning the face in the other direction, and by changing the hands.

This method we sometimes use in loosening up the cervical region in case of alveolar-pyorrhea and catarrhal affections. This method is not so specific as the one described above, but is more effective, as a greater leverage can be obtained in most cases.

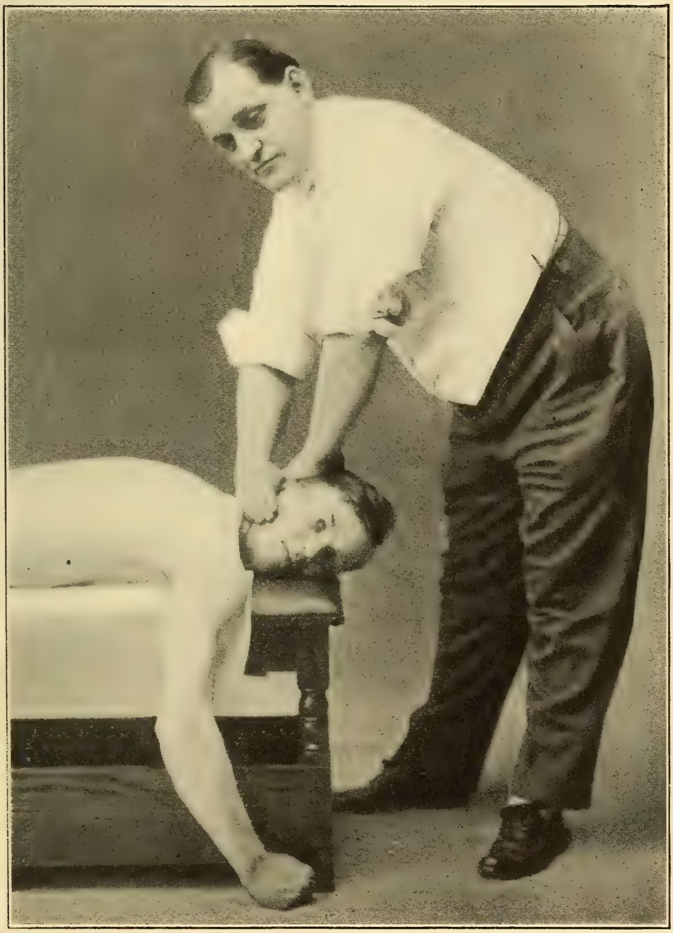
TRANSVERSE-OCCIPITAL-BIMANUAL THRUST.

(Cervical Method.)

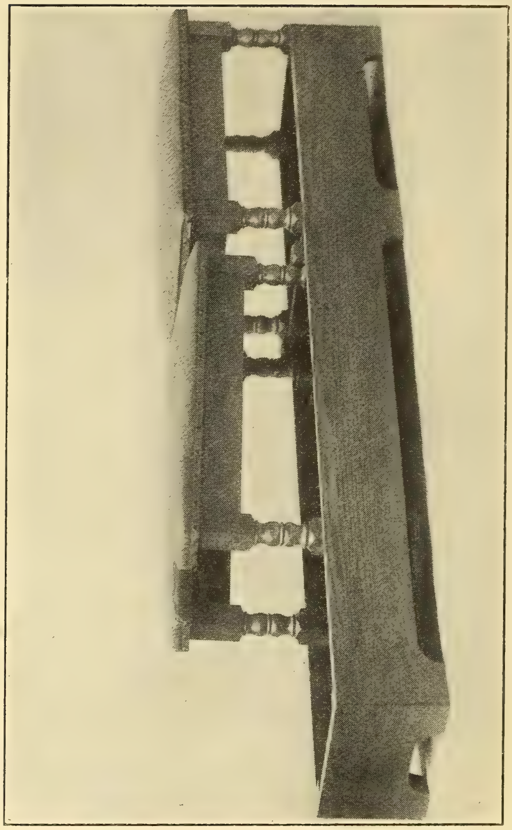
Patient prone, operator at patient's head.

Catch transverse processes on posterior sides with ulnar border or pisiform contact and direct thrust forward, and catch the occiput, as in the illustration, and thrust in the opposite direction at the same instant as thrust is given with the other hand to transverse processes.

This is an easy method and can be used to advantage in many cases. (See Illustration, page 477.)



Transverse occipital bimanual thrust (cervical method).



Our simple adjustment table closed. As the two sections separate, the back end of the front section drops lower, so as to provide room for any undue corpulence of the abdomen.

CHAPTER VI.

UPPER THORACIC METHODS.

THE adjustment of the upper thoracic vertebræ are somewhat difficult, and more especially is this true if we undertake to loosen up the articulations of the spine in this region by the first crude methods which we were taught and such as have been used in this country, and are still used by the non-progressive spinal adjusters.

The author has been much interested in obtaining different methods of adjustment of vertebræ in this region of the spine, because of the urgent necessity of more effective and more accurate methods of procedure. We are now familiar with, teach, and use near a dozen different methods of upper thoracic adjustment, each of which is especially adapted to the different conditions in which we find our different patients. We will describe each of these methods, which we enumerate as follows:

1. T. M. method (sitting).
2. Lateral method (dorsal).
3. Bimanual extension (prone).
4. Side thrust method (prone).
5. Side thrust improved (prone).
6. Mento-spinous method (sitting).
7. Mento-rotary method (prone).
8. Occipito-spinous method (sitting).
9. Old method forward thrust (prone).
10. Old method backward thrust (prone).
11. The occipito-spinous thrust (prone).

In the above nomenclature of the different methods of adjustment which we have used, the name does not clearly indicate the method of the procedure. For this reason and for the purpose of describing the methods,

the following description of the technique and advantages of the different methods enumerated above, will be considered.

1. T. M. Method. (See Illustration, page 481.)—This is an old method of procedure, and a method that is used in the cervical region, and it may also be used in the upper thoracic region as low as the second or third thoracic vertebræ.

Position.—The patient remains in the sitting posture, while the operator stands at his back.

The thumb of one hand is placed against the spinous process of the vertebra below the articulation which we desire to loosen up. The other hand is placed against the opposite side of the head. The head is flexed over the side and over the thumb in contact with the spinous process.

Complete flexion and relaxation is obtained by pressure and working the head toward the side of the spinous support. After complete relaxation give a side thrust, and the articulation will be loosened between the vertebra that is supported and the one immediately above.

Caution.—Always have the head of the patient flexed to the side, to almost the normal limit, when the thrust is given.

Always be sure that the thumb against the spinous process is held firm so as to give a sufficient support to the spinous process that is held.

It is often necessary that the opposite side of the articulation be loosened up also, and in such a case this may be done by changing the hands, using the other hand against the opposite side of the spinous process, while the other hand is applied to the other side of the head. The articulation is opened by a side thrust of the head, as described above.

This method works best for loosening up the articulation between the sixth and seventh cervical vertebræ,

T. M. method.

and between the seventh and first thoracic vertebræ, but it should be used with caution in all cases, as too much of a side thrust may cause injury to or irritation of the ligaments of the spine, and for this reason contraction will subsequently ensue.

2. Lateral Method. (Patient on back.) (See Illustration, page 483.)—This method of upper thoracic adjustment is one that the author first learned after some two weeks of occasional attempts until we became partially proficient in its execution.

It is a very excellent method, because it is effective, and also because it is a painless method of loosening up the articulations of the upper thoracic vertebræ. This method is one that requires considerable practice that we may become proficient in the art of its administration.

The technique of the operation is more complicated than most methods of adjustment. For this reason it will be hard to describe.

Position.—The patient should lie upon the back on the adjusting table, while the operator stands at the head.

A careful palpation of the upper thoracic vertebræ should be made, which can be done by using a finger of each hand on either side of the spinous processes of the upper thoracic vertebræ.

The head of the patient is raised, and the extensor muscles of the spine become relaxed. Any lateral deviation from the proper alignment of the spinous processes of this region, is in this way easily detected.

Should we find a spinous process of an upper thoracic vertebra to one side or to the other, then the following technique of adjustment may be followed:

Place the middle finger firmly against the spinous process that is prominent, because of its lateral position.

The fingers should be pressed firmly against the prominence of the spinous process that is lateral.

Lateral upper thoracic method.

The elbow of the same hand may rest against the knee for a support.

The other hand of the operator catches the occiput of the patient, and flexes the spine as much as possible around the finger that supports the prominent spinous process.

When the lateral rotation of the head is to the limit, a thrust should be given.

The occiput should be rotated more than the front of the head toward the side of the supporting finger.

The thrust should be a lateral, rotary movement instead of a lateral movement, and the head should be lowered as much as possible when the side rotary thrust is given.

The finger against the spinous process should hold it firmly.

This will loosen up the articulations between the vertebra of the spinous process which is supported, and the vertebra immediately above, and owing to the flexed condition of the neck and upper portion of the thoracic region, the vertebra will easily rotate to its normal position and is moved with ease and the adjustment is painless to the patient and a very accurate method of adjustment.

If the process should be prominent on the opposite side, then flex the head to the opposite side, and support the prominence of the spinous process on the same side to which the head is flexed. Administer the thrust in the same manner as described above, and you will reverse the movement of the vertebra.

It requires considerable practice to execute this method of adjustment effectively, but it is one of the most effective and absolutely painless methods of lining up the spinous process of any that we have seen used, and for this reason it is well worth the time and pains to acquire the art of executing this method of procedure.

Bimanual extension method. V

3. Bimanual Extension. (Patient prone.) (See Illustration, page 485.)—This method of loosening up the upper thoracic will also apply in the middle thoracic region, and is a very simple method of procedure and requires but a brief description; it is also a method that is seldom used, and this is not a very effective method of adjustment.

Position.—The patient lies in the prone position, and should be placed over a considerable roll resembling the shape of half of a barrel, or half barrel in shape. The roll should be from three to five inches in diameter.

One hand is applied over the sacrum, while the other is applied to the spinous process of a vertebra in the upper thoracic region.

Considerable tension, in this way, may be brought to bear upon the spinal column; and the thrust may be given simultaneously to the sacrum and to the spinous process of the upper thoracic vertebra.

This will bring a tension to bear upon all portions of the spine, but the point of contact of the hand to the upper thoracic portion of the spine will open up that portion of the spine first.

This is not a very practical method, for the reason that we have not always the convenience for placing the patient in a proper position for its execution, and for the further reason it is not very efficient.

4. Side Thrust Method. (Patient prone.) (See Illustration, page 487.)—The side thrust method is quite an improvement over the method that the author first learned. This is quite an effective method of loosening up the upper thoracic articulations in the majority of cases. The technique of this method may be described as follows:

Position.—The patient lies prone upon the adjusting table, while the operator stands at the side to which he wishes to give the thrust.

Side thrust method.

The patient's face is turned toward the operator, while the thrust is given to the spinous process that is to be adjusted.

A lateral position of the patient's face will tip the spinous processes of the vertebræ of the cervical region to one side, and will also rotate the vertebræ and spinous processes of the upper thoracic region, but to a less extent.

The pisiform bone of the left hand, if the operator stands on the left side of the patient, should be placed in contact with the left side of the spinous process of the vertebra to be adjusted.

The right hand reinforces the left when the thrust is given.

The thrust may be applied to the lower cervical or to the upper thoracic spinous processes, down to and including the third, and they may be effectively loosened up in this manner.

By reversing the face of the patient to the other side, the operator may stand on the same or reverse side and apply the pisiform bone of the right hand to the spinous processes of this region, and give the thrust in the opposite direction.

This method is not as free from pain as the second method described, but it is a convenient method of procedure, and one that is more easily learned and executed and more easily made effectual.

5. Side Thrust. Improved Method. (Patient prone.) (See Illustration, page 489.)—Much more leverage can be obtained in making the side thrust adjustment, by having the head raised from the table so as to increase the flexion of the spinal column in the region where the adjustment is to be given. This may be done by the following simple contrivance:

Position.—The operator stands as before, uses the hands as directed above, and gives the thrust in the

Side thrust method (improved).

same way, while the patient lies in the same position, but places one arm under the side of the head, as follows:

If the patient's face turns to the right side, then the right arm is placed under the side of the head, so that the patient's face is looking toward his elbow, and toward the side on which the operator stands.

To obtain the opposite adjustment, it will be necessary for the face to turn in the opposite direction, or to the left side of the table, while the left arm is placed under the side of the head.

The operator then stands on the left side of the table, and thrusts the vertebra towards the right side.

By placing a patient in this position, you will see at once that you can obtain a wonderful advantage and leverage, that will enable you to break up the strongest contractions or adhesions, and even anchylosis of the vertebræ of this region.

While this method is very effective, it is not a comfortable method to the patient; in fact, it is one of the most uncomfortable methods that we use, but at the same time one of the most effective.

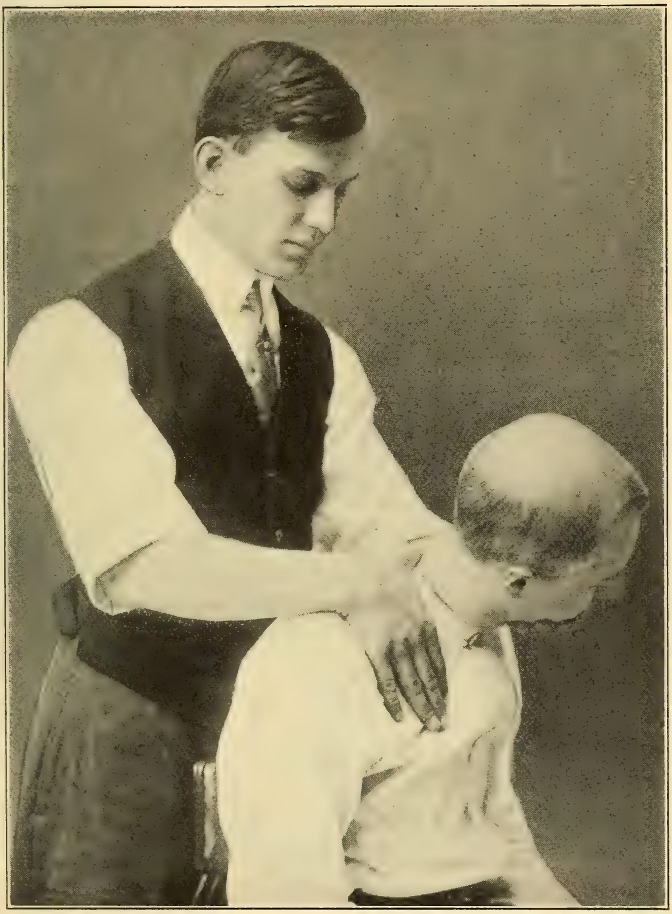
6. Mento-spinous Method. (Patient sitting.) (See Illustration, page 491.)—This method is similar in principle to the mento-rotary method described below, but is a method that may be used while the patient is in a sitting position.

It consists of a rotary method, in which the chin and spinous process are held as described below:

Position.—The patient sits on a chair, bench or stool, while the operator stands behind.

We will suppose, for example, that the first thoracic spinous process is to the right. Then we will support the second spinous process upon the left side with the thumb of the left hand.

Extend the right hand on the right side of the neck of the patient and grasp the chin.



Mento-spinous method.

The chin, then, is rotated to the right, which rotates the spinous process of the vertebra of the upper portion of the spinal column to the left.

A lateral thrust is given with the thumb supporting the spinous process. While the support is applied to the spinous process of the second thoracic vertebra, the movement tends to rotate the spinous process of the first thoracic vertebra into perfect alignment.

Change hands. Use the thumb of the right hand to support the first spinous process upon the right side.

Extend the left hand on the left side of the neck to catch the chin and rotate it to the left.

A side rotary movement of the head and neck will tend to rotate the vertebra of the upper portion of the neck to the right.

This will correct the relation existing between the seventh cervical and first thoracic vertebra, as the first thoracic is supported and not permitted to rotate.

7. Mento-rotary Method. (Patient prone.) (See Illustration, page 493.)—This method of procedure is an effective way, and a fairly easy one of opening up the articulations in the lower cervical and upper thoracic regions.

Efficiency in this method of adjustment is easily acquired. We will describe the technique as follows:

Position.—The patient lies in the prone position, the face being turned to the left side.

The thumb of the right hand of the operator catches against the right side of the spinous process of the vertebra to be adjusted and supports it.

The left hand of the operator catches and raises the chin of the patient. Forces applied to these two points of contact should be in opposite directions.

This rotates the upper portion of the spine, and the support given to a spinous process will cause a loosening

Mento-rotary method.

of the articulation immediately above the supported spinous process.

The face may be turned toward the right, while the spinous process is supported upon the left side. Then a rotary movement would open up the articulation above the supported vertebra. We rotate it in the opposite direction; we then loosen up the articulation on the opposite side.

This is a very convenient method to use as the patient lies prone upon the table, and is also a very effective, comfortable, and painless method.

8. Occipito-Spinous Method. (Patient sitting.) (See Illustration, page 495.)—The occipito-spinous method is similar to the one described above, but varies in the manner of the contact and technique.

Position.—The patient remains in the sitting position upon a chair or stool, while the operator stands behind.

The left hand is used to support a spinous process upon the left side, while the right hand is used to support a spinous process upon the right side of the upper thoracic region.

In either case, the other hand is placed against the occiput of the head.

The head is flexed forward; a side thrust is given to the occiput, throwing the head to the side to which a support is given to the spinous process by the other hand.

The side thrust is also slightly rotary in nature and the more rotary the movement the better.

This will open up the articulation above the vertebra which has its spinous process supported.

This method is a very effective way of loosening up the articulations of the upper portion of the thoracic region, and is not painful. It is not as effective as the lateral method, described above, for the reason that when the head is flexed forward, the erector muscles of the spine are brought into action, and it is necessary to

Occipito-spinous method.

overcome the muscular resistance in order to execute a successful adjustment.

9. Old Method—Forward Thrust. (Patient prone). (See Illustration, page 497.)—This is a very simple and very crude method of procedure, and may be described as follows:

Position.—The patient lies prone upon the adjustment table. Should the operator stand on the left side of the patient, then the patient's face should be turned in the opposite direction, looking toward the right.

The pisiform bone, or ulnar border of the left hand, should be placed against the spinous process of the vertebra to which the thrust is to be given.

The right hand is used to reinforce and strengthen the left hand.

The thrust then is given forward at an angle of thirty to forty-five degrees, and the articulation between the vertebra that is thrust, and the one immediately below it, is opened up.

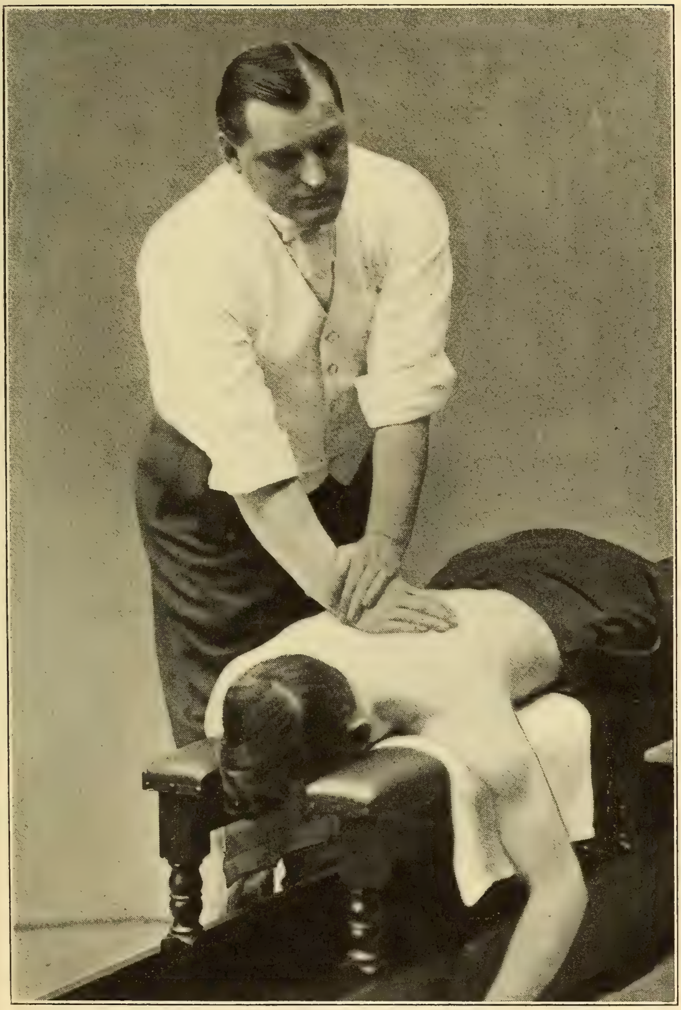
It requires considerable force to accomplish an adjustment in this way, and owing to the curvature of the spine, it is hard to get a proper contact against the spinous process, so it is not only crude, but a very difficult method to execute.

10. Old Method—Backward Thrust. (Patient prone.)—Owing to the curvature of the spine, some have sought to overcome the difficulty of obtaining a contact against the spinous process, by changing the position of the operator and the direction of the thrust which is applied.

Position.—The patient lies upon the adjusting table in a prone position.

The operator stands at the head of the patient, while the face is turned to the right or to the left.

The adjusting hand of the operator is placed against a spinous process of the upper thoracic region, and a



Old upper thoracic method.

thrust then is given downward and slightly backward, instead of forward.

This method is very, very crude, very ineffective, and one of the poorest methods we have ever seen used.

Personally, we do not use this method any more, as we have so many methods, far superior ones to this in every way.

A modification of this method we find to be excellent in some cases. The position of the patient and the operator are the same as described above. The contact is made by the ball of the thumbs or may be made by the use of the pisiform processes, upon the transverse processes of an upper thoracic vertebra. In this manner the transverse processes of either of the upper thoracic vertebræ may be thrown downward or both anterior and inferior. The application may be made and the thrust applied to both of the transverse processes of a vertebra, or we may apply the thrust upon either side instead of both sides.

11. The Occipito-Spinous Thrust. (Patient prone.) (See Illustration, page 499.)

Position.—The patient lies in a prone position on the adjusting table with face lying toward one or the other side. The position of the operator is at the side of the patient's body.

Contact.—The thumb of one hand is placed against the spinous process, on the side opposite to which it should be adjusted.

The occiput of the patient is turned toward the side on which the contact with the thumb is made.

The other hand is placed on the occiput of the patient, thus making the spinous and occipital contact.

Suppose we are wanting to throw the spinous process of the first, second or third vertebra toward the right:

Position.—We may stand to the left side of the adjustment table and body.

Occipito-spinous method.

Patient lies with his face to the side opposite the operator and with the occiput of the head toward the operator.

With the thumb of the left hand we support the first, second, or third thoracic spinous process upon the left side.

The right hand is placed upon the occiput of the patient.

The slack is all taken out by a rotary movement rotating the occiput to the left, and the spinous process which is supported is thrust toward the right side.

A slight thrust now in the two directions in which we are rotating the spine and occiput will easily accomplish the desired adjustment.

If the spinous process of an upper thoracic vertebra is to the right side instead of the left, and we wish to throw it towards the left to bring it into normal alignment, then we reverse our hold and the hand used in contact with the spinous process and occiput.

We use the thumb of the right hand against the right side of the spinous process of the vertebra to be adjusted.

The left hand then should be placed in contact with the occiput.

The occiput in this case is turned to the right, while the face is turned toward the left.

Rotate sufficient to overcome all slackness and at the same time we support the spinous process of the vertebra with the thumb of the right hand. This will cause a loosening up of the articulation between the vertebra which has its spinous process supported and the one immediately above it. This is a very easy and effective way and much superior to that used by the ordinary practitioner or teacher of spinal adjustment.

Instead of using the thumb against the spinous process of the vertebra to be adjusted, we may now use the pisiform bone as a point of contact against the transverse

or spinous process; in this case the point of contact is changed from the thumb to the pisiform bone and to the ulnar border of the hand.

The pisiform bone contact may be made upon the transverse process in the middle and upper cervical regions in making adjustment.

Position.—The patient lies prone with the head on the left side, and with the face to the right and from the operator.

The operator places the left hand with the pisiform bone in contact with the transverse processes of the cervical vertebræ.

The operator's right hand catches the head or occiput and rotates sufficient to overcome slack and then by a slight thrust we may make the desired adjustment.

CHAPTER VII.

GENERAL THORACIC METHODS.

IN this chapter we wish to consider briefly a number of different methods, which may be used in the adjustment of a patient, in the thoracic region. There are many different methods which may be and which are used.

The author of this work was first trained to use but one method, but by travel and by exchanging ideas with other practitioners, and by a study of the methods used by the Bohemians, we have enlarged our store of knowledge along this line until we are now using and teaching more than fifteen different methods of adjustment of the thoracic vertebræ.

We are thankful to many for the greatly increased knowledge we have obtained since our early education in spinal treatment, and we are glad to present to our readers the description of so many excellent methods of adjustment of the vertebræ in the thoracic region, for the reason that we wish to make them proficient in the science and art of spinal adjustment because of the great good that can be accomplished by the efficient use of this method of treatment.

In the description of the methods of adjustment, we desire to be specific, and to make the instruction comprehensible, and in order to do so, with each method of adjustment we furnish special illustrations which are prepared especially for this work.

1. Recoil method.
2. The knee thrust.
3. Shepherd methods.
4. Pisiform contacts.
5. Rib thrust methods.

6. Ulnar border contact.
7. Spinal swaying method.
8. Hollow of hand contact.
9. Bimanual rotary methods.
10. Standing in front method.
11. Thumb on spinous process.
12. Knuckle between transverse.
13. Thumbs on transverse processes.
14. Pisiforms on transverse processes.
15. Ball of thumb contact, spinous process.

1. Recoil Method. (Patient prone.)—We mention this method first, but are free to confess that we believe it is last and least in importance. It is based upon a false conception of what constitutes a subluxation, and also a false conception of what is to be accomplished when giving the thrust to the process of a vertebra. We believe, however, that this ridiculous method of adjustment is a fair sample of the knowledge and competency of its chief exponents who do not comprehend the nature or philosophy of spinal lesions or of their adjustment.

This adjustment is based upon the idea that the vertebræ slip here and there, around and about, and under the influence of a quick jar they flip, flap or flop accidentally, perchance, or, by some other mysterious way, back into place and into normal relation with their fellows.

The technique of this operation consists of a number of preliminary contortionary acts which would be hard to describe with a pen.

The recoil, however, might be described as giving a quick thrust and making a double quick getaway in order that the hand may not obstruct the accidental, may be so, perchance, slipping, flipping, flopping of the vertebræ back to where they belong or somewhere else, the Lord only knows where. We pass this, however, without a minute detail of the technique, for fear some prac-

titioners of spinal adjustment may not have better judgment than to use it.

2. The Knee Thrust. (Patient sitting.) The knee thrust method is a simple one, and one that has been used to a certain extent in a manner by our osteopathic brother.

We consider it a very indefinite method, and one that we do not use ourselves, because of the fact that we would never know what we were doing when using it. The technique is something like the following:

Position.—The patient sits on a stool, while the operator stands at the back.

The operator raises the arms of the patient, while the knee presses against the vertebræ of the spinal column.

As the arms are drawn up, the spine is straightened, the pressure of the knee against two or three vertebræ of the spine will tend to loosen up the articulations. By being careful that the patella of the knee approximates a certain vertebra, we may feel fairly confident of loosening up the articulations of that vertebra with its fellows, especially of its articulation with the adjacent one above.

We can apply the knee to either side of the spinous process, and sometimes by means of this movement may accomplish some good in spinal curvature.

We feel, however, that more specific methods of adjustment are far superior to the knee thrust, and we do not believe it will be used except by those who are crude in their methods, or used as a general method, by those who are not doing specific spinal adjustment.

3. Shepherd Method No. 1. (Patient standing.) (See Illustration, page 505.)—This is by no means a specific method of spinal adjustment. It is a crude method of opening up the spinal articulations, but it is practically a painless method, and may be used anywhere and at any time. The following explanation will describe briefly the technique of this procedure:

Shepherd method (Bohemian). ✓

Position.—The patient stands erect, and relaxed, while the operator stands at the back.

The patient locks the hands together at the back of his neck.

The operator passes his hands under the arms of the patient and catches over and around his wrists. He then lifts the patient off of the floor.

The lifting movement alone may open up some of the articulations of the thoracic region.

The efficiency of this movement would be greatly enhanced if, when the operator lifts the patient, he would give a quick jerk of the body. This will open up several of the articulations of the thoracic vertebræ almost simultaneously.

There is one objection to this method, and that is, should there be a contractured condition of the spine, then perhaps that portion would not relax as easily as the musculature of those articulations which are more nearly normal.

We have succeeded a number of times in giving almost instant relief by this procedure, and since this method of loosening up the vertebræ causes no pain whatever, it is a method worthy of consideration and one that should be used more frequently than it is at present.

Shepherd Method, No. 2. (Patient standing.) (See Illustration, page 507.)—In some cases this works more satisfactorily than No. 1. This method is not quite so easily given, for the reason that the operator cannot get so good a hold upon the patient. We find, however, that we can get a more decided effect upon the upper thoracic vertebræ by this process than by the other.

Position.—The patient stands erect with the hands folded and over the eyes, while the elbows are down in front of the chest.

The operator stands behind the patient; reaches

Shepherd method (Bohemian).

around the body and around the elbows and grasps the patient.

The operator then lifts the patient off the floor, and by the mere act of lifting, he will often loosen up the articulations of vertebræ.

As above stated, by giving a jerk of the patient after he is lifted, the effects of the method may be greatly enhanced. A light person can lift and adjust in this way a heavy person with a great deal more ease than would be apparent, and these methods have the advantage of being available for use without any equipments or appliances.

4. Pisiform Contact. (Patient prone.) (See Illustration, page 509.)—The pisiform method of contact with the spinous process is not to be recommended for general use, because it is a very imperfect contact, and it is almost impossible to use it with any precision except in certain regions.

In the lumbar region, where the spinous processes are large, the pisiform contact is an excellent way of applying a thrust to one side in cases where the spinous processes are out of perfect alignment.

In the cervical region and in the dorsal region such a method of procedure is very indefinite in its results. The pisiform contact is only an effort to change from the ulnar border contact, which will be described below and thus appear to be original. The technique of this operation is very simple, yet difficult to describe.

Position.—The patient lies in the ordinary prone position upon the adjustment table, the operator standing upon either side. We will suppose the operator stands upon the left side of the patient, for example.

The pisiform process is applied to the left side of the spinous or to the posterior edge or the upper edge owing to the direction the process is supposed to be thrust.

Pisiform contact (method No. 4).

The right hand catches around the wrist of the left hand.

The tips of the fingers also rest upon the spine to help to retain the pisiform bone in position and prevent the movement of the hand on the skin of the flesh.

A thrust is then given which will throw the spinous process away from the point of contact of the pisiform bone, or at least such a movement is intended.

If the pisiform contact is placed in the right contact in the lumbar region, it is an effectual method of giving a thrust in some cases. If, however, this manner of contact is used in the thoracic region, it is quite indefinite owing to the small point of contact in most cases.

In order that we may give a thrust from the opposite direction or side, the pisiform bone may be applied to the other side of the spinous process.

Either hand may be used on either side of the spinous process in the pisiform contact, the principal point to be observed being the position of the hand and the side to which the thrust is administered.

5. Rib Thrust Methods. (Patient sitting.) (See Illustration, page 511.)—The rib thrust method is a method of adjusting a thoracic vertebra by means of contact and with a thrust given to the ribs.

This method has been used, and to good advantage in some cases. The rib thrust is intended to throw the thoracic vertebræ backward instead of forward, as they are thrown by the ordinary methods of adjustment.

The ribs are flexible, and, in old people, easily broken, and for this reason a certain precaution should be taken when using the rib thrust methods.

There are different ways of applying the rib thrust, but we will describe but one in this connection.

Position.—The patient sits on a stool, while the operator stands at his back.

Place a strong band of some kind around the chest,

Rib thrust, thoracic method (Bohemian).

and draw the end of the band back under the arms on each side.

If the band is around the fifth rib, then support the sixth vertebra by contact against the spinous process thereof with the knee.

A backward thrust is then given by means of the band that encircles the body. The thrust is applied to the rib, but the sides of the ribs are supported by the same band that gives the thrust. In this way danger of springing or fracturing the ribs is avoided.

You will hear a decided click when the articulation loosens up, and this is because of a backward movement of the vertebra to which the ribs are attached.

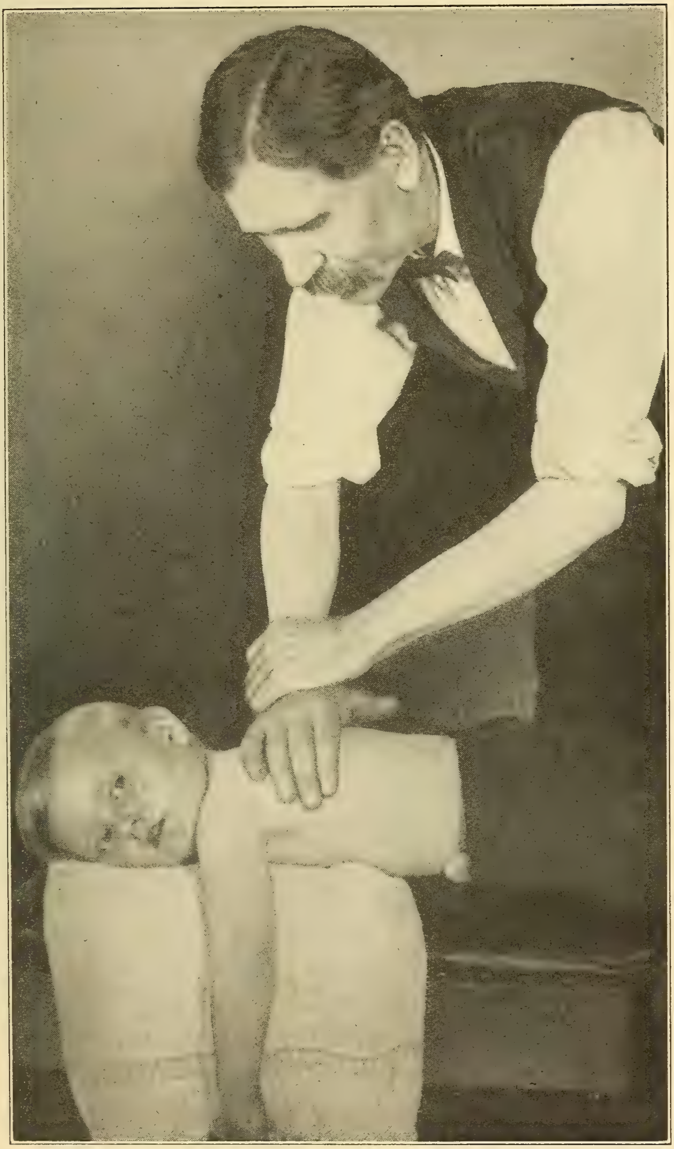
It is necessary to be careful in applying the support to the spinous process of the sixth thoracic vertebra when the thrust is given to the rib of the fifth, to protect from bruising or hurting the tissues.

We have used a pad with a deep crease in the center, and applied the knee to the pad, while the spinous processes of the vertebra fit into the crease.

The upper end of this pad should not go higher than the transverse processes of the sixth vertebra in order that the fifth may move backward without being interfered with.

This method is comfortable, effective, and should be used in the straight back, and in anterior conditions of any of the central thoracic vertebræ. The Bohemians administer this treatment by reaching around the body with their hands, and placing their heads to support the vertebra below the ones to which the ribs are attached, to which the thrust is given, or just above the vertebra to be adjusted backward.

6. Ulnar Border Contact. (Patient prone.) (See Illustration, page 513.)—This is a very commonly used method among those who practice spinal adjustment. The technique may be described as follows:



Ulnar border contact (method 6).

Position.—The patient lies in a prone position, upon the adjustment table, the operator standing upon either side of the patient.

The face, by preference, is turned to the opposite side, as this movement rotates the spinous processes more in line with the operator.

While standing on the left side, apply the ulnar border of the left hand to the spinous processes of the vertebra that is to be adjusted, or that is to be loosened from its approximation to the one immediately below.

The ulnar border is soft, and for this reason protects the tissues over the spinous processes and gives better control than the pisiform contact.

In reinforcing the left hand, in this method, the fingers of the right hand should be folded and placed upon the back of the left hand, and a little posterior to the point of the ulnar contact.

The hand should lay as flat upon the back as possible to prevent the hand from slipping or moving upon the back, and the contact greater.

The reinforcement of the right hand will direct the thrust to the proper point through the contact hand.

Should the hand stand on edge, then it will appear sharp to the patient and involuntary reflex contractions will prevent the relaxation necessary to obtain a successful adjustment.

This method is used on practically all of the spinous processes of the thoracic vertebræ, except the first one or two. It is possible to direct the force of the thrust to the right, to the left, or forward or downward by the use of the ulnar contact and to make the contact also upon the transverse processes very slightly.

7. Spinal Swaying Method. (Patient prone.) (See Illustration, page 515.)—This is not a method of adjustment so much as it is a preparatory method in which we

Spinal swaying (method 7).

loosen up the lateral spinal musculature on the sides of the vertebral column.

POSITION.—The patient lies on the bifed adjusting table, in a prone attitude especially prepared for this purpose. The face is placed in a bootjack opening in the front end of a table that is especially prepared for this purpose.

The front part or section of the table supporting the chest should rest on the back legs only.

The operator stands at the head of the patient and rotates the shoulders and head to either side by rotating from the front end of the table, and by so doing affects the spine by flexing it from side to side. The spine will flex in any portion, and we are enabled to determine which portion flexes most by supporting a certain segment.

For example, if we wish to loosen the musculature of the middle thoracic region, we have only to support directly the spinous processes in that region, and press against the movement of the body in rotating.

This will cause a decided flexure of that portion of the spine where it is supported, but the musculature of the opposite side of the spine will be affected by stretching them. This is a very useful method in spines that have been settling, and growing stiff for years.

By the persistent use of this method from day to day, the musculature of the spine may be loosened up, and the spine may become as supple as it should be normally.

It may be best in using the method of spinal swaying to have a strap to hold the hips stationary, while the shoulders are swayed from side to side.

The patient may exercise himself in this way by certain movements, while he stands and bends in different ways, and it is the movements that relax the spinal musculature that are most beneficial in physical culture methods.

Hollow of hand method.

Lateral flexion of the spine is undoubtedly beneficial for the maintenance of the normal elasticity of the lateral spinal musculature.

8. Hollow of Hand Contact. (Patient prone.) (See Illustration, page 517.)—This is one of our best methods, and possesses several advantages over the ordinary methods of adjustment in that it gives better control and the contact is more comfortable to the patient and the adjustments are more easily made when using this contact.

Position.—The patient lies prone upon the adjustment table.

Preferably, the shoulders should be lower than the hips.

This condition may be obtained by having the table properly prepared, with the front section lower than the hind section.

The operator may stand upon either side of his patient.

If he should stand upon the left side of the patient, it would then only be convenient for him to use the right hand for making the contact with the spinous processes of the patient.

The spinous process, to which a thrust is to be applied, should fit in the center of the hollow of the hand.

The hand should lie flat upon the back, with the fingers extended toward the patient's head. The ball of the thumb and the ulnar border of the hand then come in contact with the transverse processes and this makes the contact more agreeable.

The thrust then may be directed downward, forward, backward, or to either side, at the will of the operator. This method of adjustment has many advantages:

1. You have absolute control of the spinous process, and can carefully direct the thrust in any direction desired.

Bimanual rotary method.

2. The hand lies flat upon the patient, and in contact with the spinous and transverse processes, and no sharp feeling at the point of contact will produce reflex contractions and prevent the adjustment, as in the pisiform, and other uncomfortable methods of contact.

3. The pad of the muscles in the hollow of the hand will not injure the tissues over the spinous processes and make them sore.

4. The ball of the thumb and the ulnar border of the hand will rest upon the transverse processes of the vertebra, and form a triple contact, one being that of the spinous process in the hollow of the hand, and the other two being those parts upon the transverse processes.

A trial sufficient to become familiar with the use of this contact will convince any one of the efficiency and the advantages of this method of adjustment.

Personally, we feel that it is one of the best methods of contact that we use; none better, except it be a subsequent method, which we wish to describe below.

9. Bimanual Rotary Methods. (Patient prone.) (See Illustration, page 519.)—This is a useful method in many cases. The technique of it is simple.

Position.—The patient should lie in the regular prone position for adjustment, and the application is by the use of the pisiform bones of the two hands.

If the pisiform contact is used, it may be applied in the following manner:

The pisiform bone of the right hand is applied to the proximal transverse process in such a way as to thrust it forward.

The pisiform bone of the left hand is placed against the distal transverse process in such a way as to thrust it backward.

A simultaneous thrust is given to the inferior border of the process upon the proximal side, and the superior

border of the other transverse process of the same vertebra upon the distal side.

By this means, we thrust one transverse process in one direction, while the other is thrust in the other direction. This is used sometimes in crooked spines in order to correct the alignment of the vertebral spinal processes.

The hands may be folded and the knuckles may be used in contact with the transverse processes instead of using the pisiform contact, but this is not so effectual in producing any rotary effect.

10. Standing in Front Method.—This method is seldom used, and seldom does the occasion demand it, and also because it is not as specific and agreeable as other methods.

We describe it, however, as there may be circumstances in which it may be a valuable method of procedure.

Position.—The operator should stand in front of the patient.

The upper portion of the chest of the patient is brought against the chest of the operator.

The hands encircle the body, and a contact is made with the border of the thumb below and against the process to which a thrust is to be given. A quick thrust caused by tightening the hands encircling the body, will then make the adjustment. By the use of this method, we may adjust the thoracic vertebræ from the fourth down to and including the tenth, with comparative ease.

11. Thumb on Spinous Process Method. (Patient prone.)—This is a method that may be used anywhere in the lumbar, and almost anywhere in the thoracic regions, but is more difficult to use in adjusting the upper thoracic vertebræ.

The patient's body may be lifted by catching around the body under the arms.

The body is rotated to one side, while the thrust supports the spinous process of a certain vertebra.

As the body rotates, there is a tendency to open up the articulation between the vertebra that is supported by the contact with the spinous process, and the one immediately above which tends to rotate with the body as the vertebra above the contact partakes in the general rotation of the spine produced by the upward lift and rotation of the body. This works very well in the lumbar region, and is often used by the osteopath physician in adjusting the lower thoracic vertebræ.

12. Knuckles Between Transverse. (Patient erect.)—This is an effective method in many cases of loosening up the articulation between the adjacent vertebræ upon one side, and is used in the case of spinal curvature.

The patient should be lifted so as to hold the weight of the body, while the knuckle is pressed between the transverse processes upon the side that is contracted.

If there is a scoliosis, or lateral curvature of the spine, then the knuckles should be pressed between the transverse processes upon the concave side of the spine.

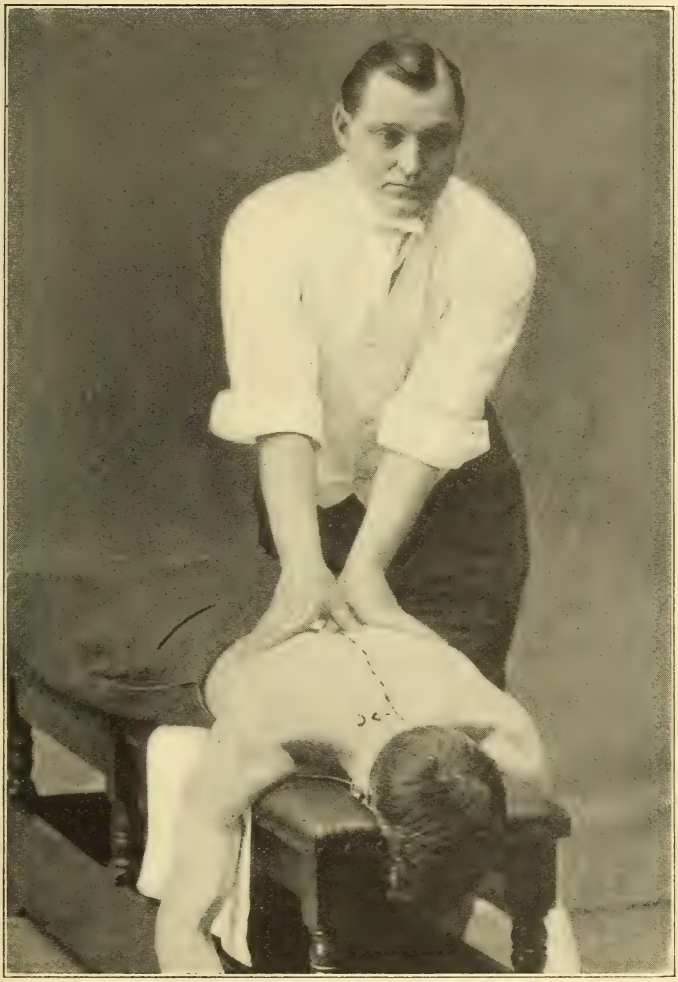
This is a method that is used by some practitioners of spinal treatment, and, from the best we can learn, this is a similar method to one that is used sometimes by Dr. Reese, of Youngstown, Ohio.

13. Thumbs on Transverse Processes. (Patient prone.) (See Illustration, page 523.)—This is a method that is frequently used, and is best done by the following method:

Position.—The patient lies prone in the ordinary position for spinal adjustment upon the treatment table.

The operator stands on either side of the patient to make the adjustment.

By crossing the thumbs and spreading them over the spinous process and by applying them to the transverse



Thumbs on transverse processes (method 13).

processes on either side, a fairly comfortable contact is obtained.

The thrust, then, is applied to the transverse processes, usually thrusting them downward and forward. A sound, as of opening up a synovial joint, is distinctly heard, and many use this method of adjustment almost exclusively because it is not painful to the patient.

This method is not only not painful, but it is thought by some to be a very effectual method in loosening up the vertebral articulations. We are not sure, however, that we always loosen up the articulation between the vertebræ, but may, instead of doing so, open up the articulations of the ribs with the transverse processes.

We know there exists a synovial sac between the articular surface of the ribs and the centrum and transverse processes of the vertebræ, and we are sure that a sound may be produced by separating these synovial membranes, and we are confident that often this sound is mistaken for the sound of the opening of an articulation between the vertebræ.

14. Pisiforms on Transverse Processes. (Patient prone.)—This is a method in which we make the pisiform contact on both sides of the spine and thrust the transverse processes in the same direction. This may be done in the following manner:

Position.—The patient lies in the ordinary prone position upon the adjustment table.

Operator stands either upon the right or left side of the patient.

The hands are crossed, and instead of applying the thumbs, the pisiform processes are placed in contact with the transverse processes of the vertebræ, and with this contact the thrust is given.

This is rather an awkward method, and hard to get a good contact on both sides at the same segment of the spine, and for this reason this method is seldom used.

Ball of thumb contact method.

In fact, we consider it inferior to using the thrusts upon the transverse processes of the vertebra.

15. Ball of Thumb Contact. (Patient prone.) (See Illustration, page 525.)—This method of contact of the hand with the spinous processes is one of our favorite plans in giving thrusts in the thoracic region from the upper lumbar all the way up to the third thoracic vertebra.

Position.—The patient is placed in the prone position upon the ordinary adjustment table, while the operator stands on either side of the table or patient.

If the operator stands on the left side of the patient then he may use the ball of the thumb of the left hand as the point of contact against the spinous process to which the thrust is to be given while the same point of contact of the right hand is placed immediately over the spinous process to be adjusted, and over the contact portion of the other hand. The right hand in this case is so placed for the purpose of reinforcing the strength of the left hand.

The thumbs and fingers of both hands spread out over the back of the patient and thus form a large surface of contact so that the patient is not enabled to tell where the force of the thrust is to be given. This is not a sharp or unpleasant contact and in fact is one of the most pleasant contacts we use, and it tends to induce perfect relaxation of the musculature of the spinal column and a most favorable condition for the administration of an effective thrust.

In all the other methods of adjustment, when giving a thrust while using other points of contact, the procedure is the same as when using the method of contact just described.

CHAPTER VIII.

LUMBAR METHODS.

THE lumbar vertebræ are the largest osseous structures in the spinal column. They constitute, as it were, the base of a pyramid which is made up of the vertebræ of the entire spinal column.

The musculature of the lumbar vertebræ is perhaps the strongest and most perfectly developed of any in the body. This is a provision that compensates in a way for the strain and superimposed weight which rests upon them, which is heavier upon the lumbar vertebræ, than any vertebræ above in any other region.

The lumbar vertebræ are not supported by ribs as those of the thoracic region, and for this reason the additional strength, in this portion of the spinal column, is necessary to supply ample protection.

As would be supposed, it requires a heavier thrust and a more effective one to loosen up the lumbar vertebral articulations, than those of any other portion of the spine.

Many devices have been sought to enable us to loosen the vertebral articulations of the lumbar regions. Some of them are good, and we hope to bring to your attention a few methods of relaxing the musculature and of loosening up the articulations of the lumbar vertebræ which will be practical and efficient, and more satisfactory than the former method so generally used by practitioners of spinal adjustment.

One of the first considerations is to get the patient into a position so that the lumbar adjustment may be easily and successfully made. This has caused considerable study and experiment on the part of those practicing spinal adjustment, and different methods and plans have been originated and recommended. In this connection,

we wish to describe a dozen or more methods of relaxing and loosening up the lumbar vertebræ in general, and also enumerate a few special methods of adjustment of the fifth lumbar.

The first thing we wish to consider in this connection, is the part of the hand which should be used in contact with the spinous process when making adjustments of the lumbar vertebræ. We have four points of contact which are principally used:

1. Ulnar contact.
2. Thumb contact.
3. Pisiform contact.
4. Hollow of hand contact.

Besides the above four methods, we adjust the lumbar vertebræ without any contact with the spinous process of the vertebræ themselves, simply using the extremities as levers for body movements, and in this way we bring about adjustment by the rotary methods which loosen up the spinal articulations generally, but not specifically as we often wish to do.

1. Ulnar Contact.—This contact is perhaps used as much as any other, and it has this advantage: We are enabled to get the ulnar border of the hand between the spinous processes, or behind the spinous process to be adjusted in a specific manner, and the ulnar contact furnishes a soft cushion and comfortable contact with the patient's lumbar region if it is perfectly applied.

We have an advantage, also, in that the thrust may be given in almost any direction desired. From the standpoint of convenience and of universal application, this is perhaps the most practical method of making the lumbar adjustment in many cases.

2. Thumb Contact.—The thumb contact is used in connection with certain methods of lumbar adjustment, and can only be used when a side movement of a spinous process is desired and may be best accomplished by a

rotary movement of the body while the contact is made against the spinous process with the thumb holding one spinous process stationary, while the spinous process and vertebræ above it are rotated.

If we find, in the lumbar region, any failure of the proper alignment of a spinous process, it is a positive sign of a spinal lesion or subluxation. In the illustrations of methods of adjustment below, the method of using the thumb contact is well illustrated. (See Illustration, page 525.)

3. Pisiform Contact.—The pisiform contact is a very useful method in giving a lumbar adjustment. In fact, this is the only region where the pisiform contact can be used successfully and with any degree of accuracy.

The spinous processes in the lumbar region are large and they are quadrilateral in form. For this reason we can obtain a pisiform contact against either of the four surfaces, and this enables us to throw the spinous process in any direction desired.

In lateral conditions of a spinous process in the lumbar region, the pisiform contact is an excellent way to relax the musculature that is drawing the vertebræ out of proper alignment. This is one of our best methods of contact in the lumbar region, but we discountenance the use of this contact in any other segment of the spine, because of the superiority of other contacts.

4. Hollow of Hand Contact.—The hollow of the hand contact is a most useful method in all portions of the spine, and this works well in the lumbar region, especially in the adjustment of the upper lumbar vertebræ. The first, second, third, and even the fourth lumbar vertebræ may be adjusted easily by the use of the hollow of hand contact. This has the advantage of being a comfortable contact, and consequently one that does not excite resistance by causing involuntary muscular contraction.

As remarked above, we often loosen up the articula-

tions of the lumbar region without making any direct contact with the processes of the lumbar vertebræ. This may be done in different ways by using one of the lower limbs as a lever, by using the trunk as a lever, by a thrust upon the sacrum, with the patient over a roll, or by a thrust upon the shoulder while the patient remains sitting flexed in a proper attitude.

These methods of loosening up the lumbar articulations are not so universally specific as the direct thrust, but they have the advantage of being less painful; in fact, in most cases, these plans of adjustment are painless methods of loosening up the lumbar articulations and are therefore to be commended.

There is another important consideration in lumbar adjustment, and that is the matter of securing the relaxation of the musculature of this portion of the spine, that we may be enabled to open an articulation more easily. It is an impossibility to have any decided effect or make a successful adjustment of the lumbar region when the musculature thereof is tensed, or in a tonic state of contraction.

The musculature of the posterior surface of the spine must at least be relaxed before we will be able to get any loosening up of the articulations of the lumbar vertebræ. Different methods have been used to secure relaxation. As a preface to the study of lumbar methods of adjustment, we call attention to different methods of procedure to secure relaxation of the musculature of the lumbar region:

1. Bifed table method.
2. Over a roll method.
3. Raising limb method.

These are the principal methods of securing relaxation, that have been, and are now being used in giving the specific thrusts.

Bifed Table Method.—The Bifed table method was the first one used by the Americans, to secure the relaxation of the musculature of the lumbar region for the purpose of making an adjustment of a lumbar vertebra.

This method consists of having the two sections of the Bifed table, back and front, arranged so they may be separated. The chest of the patient, and the knees or thigh, rest upon the proximal ends of the two sections of the Bifed table, while the body is suspended between the sections.

Some patients are able to relax in this way, and when the erector muscles of the spine are completely relaxed, we are enabled to get a loosening up of the articulations of the lumbar region by a direct thrust.

A great many practitioners of spinal adjustment are still using this method, and in many cases it works remarkably well. There is an element of fear, upon the part of the patient, connected with the use of this Bifed table that prevents relaxation, and this is true with quite a percentage of patients.

There is a feeling of insecurity that causes a great many of them to voluntarily or involuntarily contract the musculature of the spinal column, so that an adjustment is practically impossible, and if the adjustment is forced, it then becomes very painful to the patient because of the resistance made against it and the injury done to the fibrillæ of the spinal musculature caused by forcing relaxation.

This method of securing relaxation is open to some objections:

(a) That of the element of fear on the part of the patient is most potent against obtaining any movement.

(b) There is also possibility of danger of injury to the spinal musculature of the lumbar region.

When the spinal column is flexed until the posterior

surface of the lower portion of the spine is quite concave, the spinous processes of the lumbar vertebræ are thrown into contact with each other. In some cases the spinous processes of the lower lumbar vertebræ normally articulate sufficiently for the development of synovial membrane between them.

When the spinous processes are thrown so as to approximate each other by flexing the spine between the segments of the tables, then it is hard to loosen up the articular surface between the lumbar vertebræ without causing the spinous process to which the thrust is given, to pass to the side of the one immediately above it. This has no doubt been done in some instances by people who use the Bifed table method. The more complete the relaxation of the patient the more danger there is of thrusting a spinous process to the side of the one immediately above it.

Such a misfortune would injure the ligaments of the lumbar region, and cause a decided contraction, which might give permanent trouble, unless the matter should be properly corrected by a competent adjuster.

In our experience of nearly five years of spinal adjustment, we have seen but a few cases which have been injured in this way, and the writer has been able to correct some mistakes which have been made by others, by this method of adjustment, and we believe there is more trouble coming from this method than any other method that is used on the entire spinal column, unless it be the former crude methods in the lower cervical or upper thoracic regions.

Over a Roll Method. (See Illustration, page 509.)—Some careful practitioners of spinal adjustment have, in an effort to get away from the objectionable method of dropping the patient between tables, hanging them, as it were, by their eyebrows in front, and their toenails on the back table, adopted the plan of elevating

the hips by using a roll under them. This roll is placed across the table and is immediately under the pelvic bones. This has some advantages:

1. It raises the abdomen above the table so that it will not be thrust against it when the adjustment is made.

2. This position also favors a separation of the spinous processes, as it tends to throw the spine into a curve backwards. This enables the operator to palpate with much more accuracy, and also permits a more accurate contact to be obtained against the spinous processes.

These advantages are largely overcome, however, by the fact that in this position we are not enabled to get a perfect relaxation of the musculature of the lumbar region, hence the adjustments are difficult to get, and if we succeed in making an adjustment, it is apt to be more painful than if the adjustment was made when the musculature of the spine is completely relaxed.

While the above mentioned is the best method for palpation of the lumbar lesions, and also the best method for obtaining a contact with the spinous process, it still falls short of being the best lumbar adjustment, by reason of the fact that we cannot obtain complete musculature relaxation with the patient in this position.

Raising Limb Method. (See Illustration, page 335.)—The Bohemians use a method of obtaining relaxation of the lumbar region by raising the limb while the patient lies in the prone position. This raises the pelvis off of the floor, or off of the Bohemian adjuster's table, and this method, used by a few American adjusters, relaxes the erector muscles of the lumbar regions; in fact, gives us a better relaxation than the Bifed table method, described above. This is a far superior method of obtaining relaxation, as the patient does not resist and feel unsafe, as when he is suspended between two portions of a Bifed table. When the chest rests against the back end of a Bifed table there

is not only an uneasy feeling and lack of comfort, but some danger of injury to the thoracic tissues.

Raising the feet or lower extremities is open to objection, however, for the reason that the spine is flexed forward, and the spinous processes are thrown in contact with each other, and for this reason an adjustment is almost impossible without a possibility of thrusting one spinous process laterally and to one side of the one immediately above in some cases.

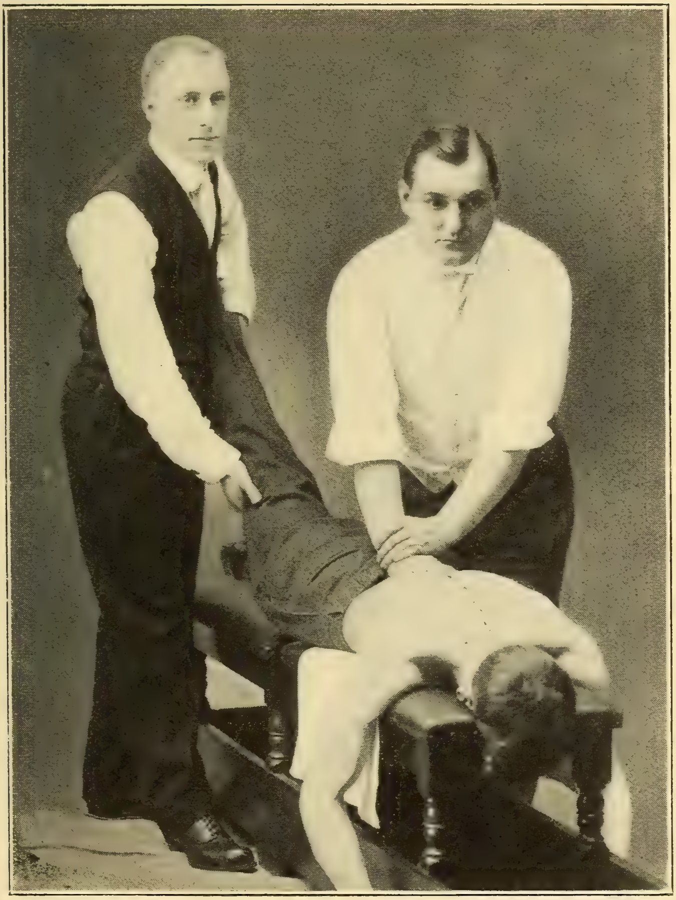
While this method is an improvement over the Bifed table method, a modification of this method becomes at once our favorite and best method of obtaining relaxation and making lumbar adjustment that we have used. The modification of this adjustment, that we have put into use, and have learned by experience is far superior to any other method of securing lumbar relaxation and adjustment, is as follows:

The patient should lie over a small roll, or an elevation on the adjustment table, so that the abdomen is free from pressure or contact with the table.

We have contrived a plan by which we drop the back end of the front section of the Bifed table, and in this way we make room for the abdominal prominence and at the same time sustain the pelvis in a raised position.

To secure relaxation, we have an assistant raise one knee about twelve to fifteen inches high, depending on the flexibility of the musculature of the patient, while the other leg remains straight. We find this relaxes the lumbar musculature completely. We have often, in experimenting with this method of procedure, requested the patient to contract and resist us when we were about to give the thrust. The answer almost invariably is the same: "I can't."

When the limb is once raised, it is impossible for the patient to contract the spinal musculature and resist the



Raising limb, lumbar method.

thrust successfully. This is a very important feature of this method of procedure.

Again, we notice that when the musculature of the spine is relaxed by raising one extremity instead of two, that the spine is not flexed as when both limbs are raised. The contour of the spine is altered but slightly. We have in this way relaxation without flexion. This is a very important consideration.

This prevents the spinous processes of the lumbar vertebræ approximating each other, permits a more specific contact to be made, and prevents the possibility of throwing a spinous process to the side of its fellow, immediately above.

There is one other feature about this method of procedure that is also helpful, and that is, when the limb on the opposite side of the patient is raised, the spinous processes of the lumbar vertebræ are tipped in the direction of the operator, and since they are tipped in this direction, the operator is less apt to give a lateral thrust when it is not desired. In other words, it throws the field of operation in line with the work of the operator.

This is a very important consideration, and leads to the following advice: Always raise the limb on the opposite side when you wish to relax the musculature of the lumbar region and raise but the one limb.

After considerable experience, we are fully satisfied that the position and procedure just described is decidedly the best method of securing spinal relaxation so that we may succeed with lumbar adjustment with little or no discomfort to the patient.

LUMBAR METHODS OF ADJUSTMENT.

We enumerate the following methods of procedure:

1. Old method.
2. Side thrust.
3. Recoil method.

Old method No. 1. Except back end of front table is lower.

4. Rotation method.
5. Thumb thrust method.
6. Ilium thrust method.
7. Spinal swaying method.

The above we believe embrace the principal methods of procedure in making lumbar adjustment. These methods are combined with the different contacts and different methods of securing spinal relaxation, which we have described above. A combination of these methods, together with the methods of securing contact and relaxation, gives us a number of different methods of procedure in making lumbar adjustment.

We believe that, in presenting the subject in this way, we are presenting it in the most comprehensive way we can.

1. OLD METHOD. (See Illustration, page 537.)—This method was first used in America, and was the first and only method that the writer used for some two or three years, when his attention was called to better methods, since which time we never use the old method.

POSITION.—Patient is placed upon a Bifed table with a space intervening between the two sections.

The chest rests on the front table, while the thighs and knees rest on the back table. This is sometimes expressed as follows: the patient's eyebrows on front table and with the toe nails on the back table.

The patient is then instructed to relax completely, allowing himself to hang, as it were, or suspend between the sections of the table.

When the most possible relaxation is secured, a downward movement and thrust is given, usually with the ulnar border or pisiform contact. This thrust movement consists of a double wave of impulse.

The first movement or wave of impulse carries the vertebræ to the point of complete relaxation, while an

auxiliary wave of impulse increases the force and speed of the thrust, so as to open up the articulation.

It is essential that just the right movement is given in making this adjustment. If the final thrust is given before complete relaxation is obtained, there will be no adjustment accomplished. The success of the adjustment depends wholly on securing, first, a thrust of slow velocity which carries the spine to the point of complete relaxation, and then of an auxiliary wave of impulse that follows immediately without any cessation, or latent period of time, between the two waves of impulse constituting the thrust movement.

The second impulse simply adds to and increases the first in force and velocity. It is a wave on top of a wave of force.

This method, however, we believe is only used by the practitioners of spinal adjustment whose information as to methods is limited, and it is fast falling into disuse, as the superior methods are becoming more widely known to the practitioners of chiropractic spondylotherapy.

We believe there is no condition in which such an adjustment is advisable or best, and fully believe that this method of procedure should be wholly cast into oblivion.

2. Side Thrust Method. (See Illustration, page 540.)—This method of procedure consists of the following technique:

Position.—The patient lies prone upon the adjustment table, which should be level, or practically so, unless there is considerable protuberance of the abdomen, in which case allowance may be made by dropping the back end of the front table.

If the operator stands on the left side of patient, the pisiform bone of the left hand should be placed in contact with the spinous process of the lumbar vertebra, to which the thrust is to be given.

Side thrust (method 2).

The right hand catches the opposite knee and raises it and draws it towards the operator so as to flex the spine, with the convexity thereof on the side of the operator and this becomes most acute at the point of contact of the operator's hand.

This movement stretches the musculature of the distal side of all portions of the spine as the thrust is given to each spinous process consecutively.

When relaxation is secured, and flexion or swaying of the spine is complete as far as possible, a thrust is given with the pisiform bone of the left hand against the spinous process of each lumbar vertebra.

The knee, which is held by the right hand, should be drawn, at the same instant the thrust is given, towards the operator, causing spinal flexion.

A combination of the two movements of the two hands brings a decided leverage upon the lumbar vertebra or the spinous process thereof.

This operation may be repeated until a thrust is given to each of the spinous processes of the lumbar vertebræ. This operation may be reversed as follows:

The operator steps to the other side of the patient, and uses the pisiform bone of the right hand against the spinous processes of the vertebræ on the opposite side.

The left hand catches the knee of the patient, and draws it toward the operator. A combination of the thrusts from both sides will loosen up the musculature on both sides of the lumbar region of the spine, and in case of any settled or contracted condition of the musculature of the lumbar region, this is a very efficient method of procedure.

3. Recoil Method.—This consists in applying the pisiform bone in some contortionate manner to some surface of a spinous process of a vertebra of the lumbar region.

It consists of a conspicuous preliminary procedure and of a very quick thrust, and of a decided recoil action on the part of the operator, with the hopes of having a consequent recoil on the part of the vertebra, by which it accidentally, perhaps, perchance, or in some way, happens to fall, flip, flop, or fly into some normal or abnormal relation to its fellow.

4. Rotation Method. (See Illustration, page 543.)—Rotary movements of the vertebræ of the lumbar region are very effective ways in which to open up the articulations of the lumbar vertebræ.

Rotation of the vertebræ without any contact to the spinous processes, is not a very specific method, but it is an excellent general method of opening up one or all of the articulations of the lumbar region, and even affects some of the vertebral articulations of the lower thoracic region, and possesses the advantage of being an absolutely painless method in practically every case. The rotary movement may be described as follows:

Position.—The patient lies on either side, with his arm under him or to the front of the body.

The operator stands at the side of the adjustment table and to the side to which the patient's face is turned.

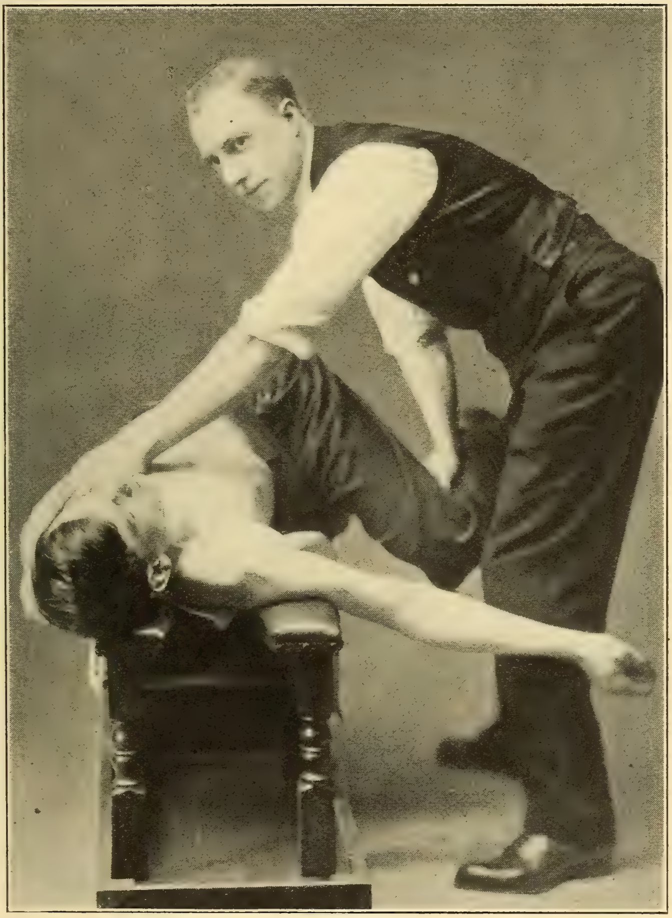
The knee of the operator is thrown against the lower knee of the patient and supports it in a straight attitude.

The upper knee of the patient is raised and flexed so that the foot catches upon the thigh of the operator.

In this way we obtain a good leverage, by means of the upper extremity, to rotate the spine and loosen up the articulations.

The other hand of the operator catches the patient's shoulder, and rotates the shoulder back, while the hips are rotated toward the operator. This brings a decided rotation of the spinal column.

If the thrust is given to the knee, it will affect most of the lower lumbar vertebral articulations, directly loosen-



Rotary lumbar method No. 4.

ing up the fifth, and possibly all of the lumbar articulations, with a single movement.

If the force is applied mostly to the shoulder of the patient, while the hips are held more at rest, then we may loosen up the thoracic vertebral articulations also by this method of procedure.

The portion of the spinal column that is affected most, depends entirely upon the manner of the thrust or place of the application of the force or thrust.

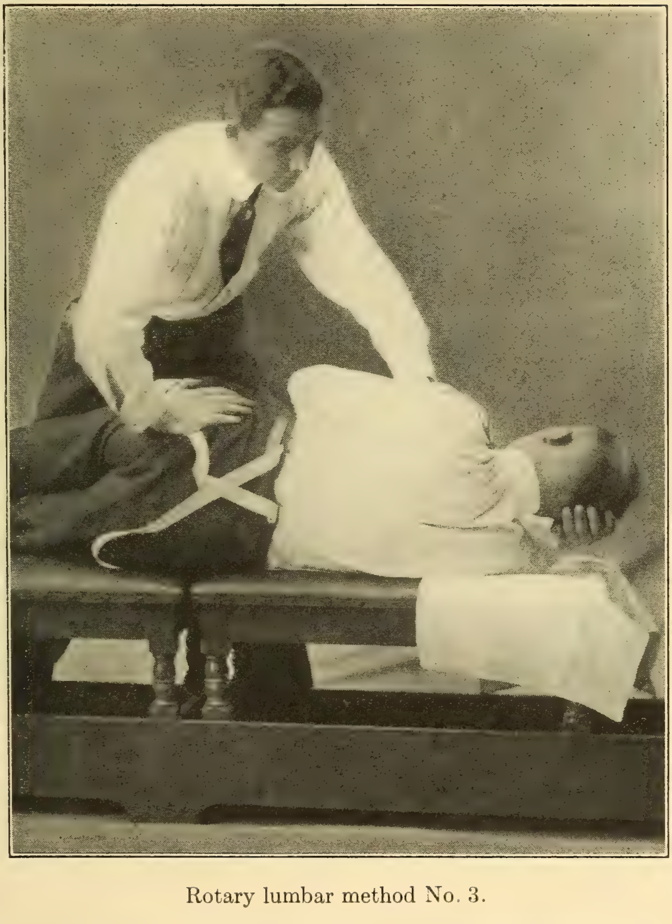
This procedure may be reversed, by the operator standing on the opposite side of the table, and by the patient facing to the other side of the table. The other limb then becomes the lever, the other hand is used to catch the knee, while the other knee of the operator is used to support the knee of the lower limb of the patient.

The opposite hand of the operator catches the shoulder of the patient and the rotation and thrusts are applied in the same manner as described above.

This we consider one of the easiest and most effective methods of loosening up the lumbar vertebral articulations, and a trial will convince anyone of its efficacy and advantages. The following rule we especially observe:

If the sciatic nerve on the left side is affected, then we lay our patient on the left side and use the right leg as a lever, throwing the right shoulder back, while the right hip is pulled forward toward the operator. This will loosen up the articulation on the opposite side of the spine, or upon the left side where the nerve's integrity is involved.

In lumbago we loosen up the articulations easily by this method, but we always pull toward us the leg as a lever upon the opposite side to the location of the tender nerve. In some cases we may use both limbs as levers, and thus open up the foramina on both sides of the limb. In this case we would use the limb on the side of



Rotary lumbar method No. 3.

the tender nerve, first as a lever, and second, and last, we would loosen up the foramina on the opposite side, that is, upon the side on which there were tender nerves by the use of the limb of the opposite side of the spine from the tender nerve.

A modification of the above method may be used quite successfully in which the spinal musculature is not too well developed. It consists of having the patient lie upon the side with the face towards the operator, with both limbs straight in line with the body.

One hand of the operator should be placed upon the posterior portion of the crest of the ilium, while the other hand catches the anterior portion of the shoulder.

The hips are rotated toward the operator, while the shoulder is rotated in the opposite direction. (See Illustration, page 545.)

This will cause a rotation of the spinal column, and a loosening up of the articulations between the vertebræ generally.

If the thrust is most decided upon the shoulder, then the rotation and loosening up of the articulations will be most decided in the thoracic region.

If the thrust is most decided upon the ilium, then the effect will be greatest upon the lower lumbar vertebral articulations.

5. Thumb Thrust Method.—The thumb thrust method may be used in connection with a rotation movement of the spinal column, and is used considerably in the lumbar region by certain practitioners of spinal adjustment.

If the body of the patient is raised by catching under the arms, the thumb may be placed against the spinous process of the lumbar vertebra in such a manner as to hold one stationary, while the segment of the spine, or the vertebra immediately above, would tend to rotate with the remainder of the spinal column above.

Ilium thrust method No. 6.

This movement would open up the articulation between the vertebra which is supported, and the one immediately above it.

By reversing the rotation of the spinal column and side of point of contact, we may open up the other side of the vertebral articulation also.

The thumb thrust method may be used in connection with the rotation of the lower extremity, and the rotation of the lower segment of the spinal column. The principle, however, is the same. If one vertebra is held stationary while the other vertebræ are rotated, the articulation between the one that is held stationary and the one above that is rotated, will be opened up, but in case the lower limbs are used as levers to rotate the lower portion of the spinal column, then the articulation between the vertebra supported, and the one immediately below it, will be loosened up, provided the thrust is most forcible which is applied to the lower extremity.

This is a fairly good method to use in some cases, but we do not believe it is an effective way to loosen up articulations of the lumbar vertebræ, and falls far short of getting the results that we obtain by the rotary movement, and by the specific thrust when the spine is properly relaxed; for this reason this method is not accepted and used by spinal adjusters.

6. Ilium Thrust Method. (See Illustration, page 547.)—This method of procedure is an excellent way of affecting the articulations of the lower lumbar vertebræ, more especially the articulation of the fifth lumbar with the sacrum.

We often find that one ilium is higher than its fellow. In such cases a thrust to the superior crest of the higher ilium and the force is directed downward. This will help materially in correcting an elevated condition of an innominate. Just before or after doing this, a thrust should be given to the trochanter of the femur

Ilium thrust method No. 6.

upon the opposite side, throwing the ilium in an upward direction.

If we have drawn the heels together in a straight line with the body, in making an examination of a patient, we will often find that one limb will be half an inch, more or less, longer or shorter, than its fellow. A thrust to the crest of the ilium on the side of the shorter limb, throwing the innominate bond downward, while a thrust in the opposite direction on the side of the long limb, throwing the innominate bone upward, will often equalize the length of the limbs at once. A continuation of this practice for a sufficient time may balance up the limbs of the patient, which is no doubt due to simply changing the relation of the articulation of the fifth lumbar with the sacrum.

We have also used this method of procedure successfully in relieving interference with nerves of the lumbar region. Suppose, for example, that the nerve supply upon the right side of the lumbar is involved, causing pain, uneasiness or disease of the right extremity or the joints thereof. A rotary thrust on the crest of the left ilium, as the patient lies prone upon the treatment table, will open up the foramina upon the right side of the lumbar region, and relieve interference with the nerves.

By this procedure we have been able to relieve some chronic cases of sciatic rheumatism. We believe, however, that the rotary method described above is much superior to this procedure in most cases.

7. Spinal Swaying Method. (See Illustration, page 515.)—This is a simple and effective procedure of relaxing and loosening up the musculature of the lumbar region. The technique of this operation is simple:

Position.—The patient lies prone upon the adjustment table.

The front section of the Bifed table should be so

arranged that it will stand on its hind legs and rotate from side to side, as described under methods of thoracic adjustment, above. For a further description of this method, see the previous chapter.

CHAPTER IX.

METHODS OF ADJUSTMENT OF THE FIFTH LUMBAR VERTEBRA.

METHODS of adjustment of the fifth lumbar vertebra are very important, and an understanding of the best methods is very helpful for the reason that lesions of this vertebra, while they are rare, are most difficult to correct, especially when we try to do so by the old methods of adjustment, which we originally learned and used. We are glad now that we can describe, in a manner, some of the better methods of fifth lumbar adjustment, and instead of using one method as we were taught, we teach and use half a dozen methods of procedure.

The fifth lumbar is very apt to become subluxated, and for several reasons its relation to the sacrum is liable to become altered.

1. Its shape.
2. Its position.
3. Superimposed weight.

1. Its Shape.—The fifth lumbar is wedge-shaped, the posterior portion of its centrum being very thin compared with the anterior portion, which is much thicker.

The shape of the centrum of the fifth lumbar vertebra accounts mostly for the abrupt turn or change of directions of the anterior contour of the spinal column at the sacral prominence, which is situated at the sacro-lumbar junction of these spinal segments, and is called the sacral prominence.

This wedge shape of the fifth lumbar renders it liable to a forward subluxation. Were it not locked very firmly by the articular processes, there would be many more

subluxations and luxations of this vertebra than we have. Also, the strong muscular attachments of the lower lumbar vertebræ and sacrum, is a protection against a forward movement of the fifth lumbar vertebra.

Its Position.—The fifth lumbar, a movable vertebra, is articulated with the sacrum which is an immovable and solid segment of the spinal column. For this reason this articulation suffers more than any other articulation of the spinal column, being at the union of a solid and a movable segment of the spinal column.

A person who may alight upon his feet from a fall, or in jumping off of an elevation, may suffer from a subluxation of the fifth lumbar because of the force of that fall, which will materially affect the tissues of the lumbosacral articulation. This is because of the fact that the long bones of the leg do not give or compress, but drive the innominate bones upward. The innominate bones, being firmly attached to the sacrum, the force of the fall will be felt very distinctly against the fifth lumbar or at the lumbo-sacral joint and less distinctly on each subsequent articulation above.

On the other hand, any weight on the shoulders, or any jars upon the upper extremities of the body, will spend their force particularly on the lumbo-sacral articulation. This is due to the physiological law, that when one end of an extended column is set in motion, that motion is transmitted to the other end. Any weight, force, or jar on the upper extremity, then, will spend its force on the lower end of the spine, or where the true, or movable vertebra articulates with the solid, or immovable segment, the sacrum.

Superimposed Weight.—The superimposed weight of the body bears more heavily on the vertebral segments of the spinal column as we pass downward. At the fifth thoracic segment, only that portion of the body above it tends to settle that portion of the spine.

At the tenth thoracic vertebral segment a much larger portion of the weight of the body above, because of gravitation, brings pressure upon this region or segment.

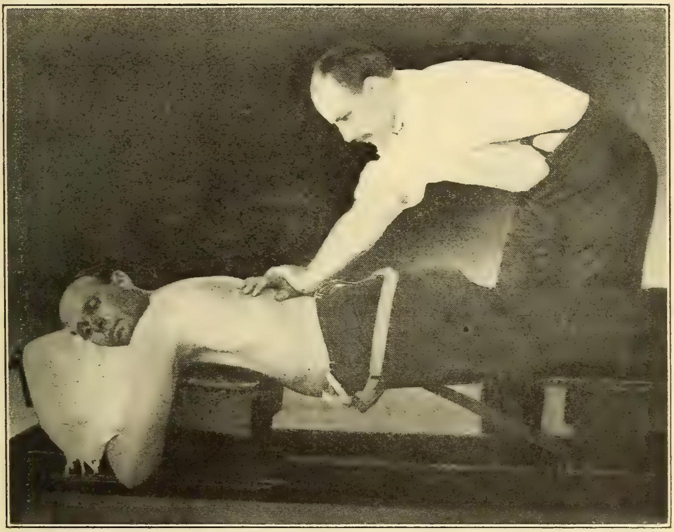
In case of the fifth lumbar vertebra the entire weight of the head and trunk of the body is supported by the lumbo-sacral articulation. This fact, connected with that of the shape of the fifth lumbar vertebra, will show plainly why there is a tendency to force the fifth lumbar vertebra anterior.

Owing to the precautionary measures in the strength of the musculature spoken of above, this abnormal condition of the fifth lumbar is prevented in a great measure. We seldom in practice find cases in which the fifth lumbar is decidedly anterior. When we do find such cases, there is always material trouble with the nerve supply to the rectum and lower extremities, and we also find it is necessary to know and use suitable methods of procedure for the reduction of such lesions.

In our first work on spinal adjustment, we knew of but one method of adjustment, and that was a very crude one, and inefficient. We call your attention to several effective methods of fifth lumbar adjustment which we enumerate under the following heads:

1. Old method.
2. Over a roll.
3. Rotary method.
4. Bohemian method.
5. Sacral thrust method.
6. Thumb thrust method, lying.
7. Thumb thrust method, sitting.

All of the above have been used, and are being used to-day by the most efficient practitioners of spinal adjustment. There are some of these methods that we favor, but we will describe all of them briefly for the sake of those who are progressive and those who would be resourceful.



Imperfect old method No. 1

1. Old Method. (See Illustration, page 555.)—The old way of adjusting the fifth lumbar was by suspending the patient between the two sections of a Bifed table while he relaxed, or tried to, between the sections of the table.

The ulnar border of the hand was then pressed in front of the sacrum, and a downward and forward thrust was given. This was the only method that we used for some time, but all the time we used it we felt that it was unscientific, for the reason that if we did occasionally have a subluxation of the fifth lumbar, the tendency was for it to slip forward, hence a thrust that would drive it forward, would evidently only aggravate the trouble which existed.

In our anxiety to break away from this unscientific form of adjustment, we contrived the method of adjusting over a roll. Others have devised the same expedient and probably for the same reason.

2. Over a Roll. (See Illustration, page 557.)—In this method a roll of suitable size is placed under the pelvis as described in the previous chapter. This method separates the spinous processes of the lower lumbar vertebræ and enables us to apply a thrust to the spinous process of the one desired. For this reason we are able to get a point of contact back of the tip of the spinous process of the fourth or fifth lumbar with greater ease. A forward thrust should then be given and is much more effective because of the better contact we may obtain.

This is quite an improvement over the method of supporting the patient between two sections of a table, because when they relax between the sections, the spinous processes of the lower lumbar vertebræ are so approximated that we cannot apply the thrust to them with any accuracy.

This method, however, failed to solve the problem

Over a roll method.

of what to do in case we had an anterior condition of the fifth lumbar vertebra relative to the sacrum.

This condition, we are confident, can be corrected by different methods, and one method which we will next mention, which seems to correct, in a measure, this condition, is what we call the rotary method.

3. Rotary Method. (See Illustration, page 543.)—This method has been described in the previous chapter, in which we discussed more fully the lumbar methods of adjustment.

We will add, however, that if we desire to affect the articulation between the fifth lumbar and sacrum, we should do so by a suitable movement for that purpose.

As the patient lies in position for the rotary lumbar method, and as the limb is used for the lever, the upper part of the trunk should be rotated from the operator, while the hips are rotated toward the operator by the hold on the knee.

When the thrust is given, it should be given wholly with the lower extremity as a lever. The force should apply to the lower end of the spine, first and most.

This method will loosen up the lumbo-sacral articulation with comparative ease and certainty, and will often give quick results in the way of relief of ailments of the lower extremity.

We should observe the same rules as indicated above in Chapter VIII. on Lumbar Methods, namely: If the knee of the left leg is ailing, then use the right extremity as a lever for rotating for the relief of the fifth pair of lumbar nerves and the lame knee.

4. Bohemian Method. (See Illustration, page 559.)—One of the best methods of adjustment of the fifth lumbar vertebra that we have learned is from the Bohemian system of spinal adjustment, and may be described as follows:

Position.—According to the Bohemian way of giving

Bohemian fifth lumbar method.

this adjustment the patient lies flat upon the back on the level floor.

Arms are extended directly above the head, and feet and legs extended straight.

The patient then raises the body up, retaining the arms directly overhead, and he continues to bend forward until he is flexed to the limit, with the hands still held up over the head.

The operator applies a thrust to the top of the shoulders. The force of this thrust, according to the physiological law indicated above, travels to the lower end of the spine, and the force of it is spent upon the lumbo-sacral articulation.

In America, often the patient's feet are too light to balance the patient; consequently it is necessary for the operator to bear down on the feet while the patient raises his body from the floor. There have been some modifications of this maneuver, one of which we often use, and it may be described as follows:

The patient sits on the floor with the legs flexed at the knee, instead of remaining straight, as in the procedure described above.

Then the hands are stretched above the head, and the body is thrown forward between the knees. This produces a very sharp angle at the lumbo-sacral articulation.

A thrust is then applied to the top of the shoulders, the force of which is spent on the articulation between the sacrum and the fifth lumbar vertebra.

Owing to the angle of the body, the tendency is to throw the fifth lumbar vertebra back and out, the same as is intended to be done in the other procedure, described above.

We believe there is some advantage in folding the knees, for the reason that it seems that the body can be flexed more, and that the outward angle of the lumbo-

sacral union is thereby increased, and the more this angle is increased, the more will be the tendency to throw the fifth lumbar outward, as the result of a downward thrust and an upward resistance of the solid sacral segment against it.

Still other modifications of this method have been made, but the above two methods we believe are the best, except in cases of children. The point to be watched in giving the above thrust to throw the fifth lumbar out, is as follows:

If the spine is bent at a sharp angle anywhere above the lumbar region, there is a chance of the force of the thrust being spent at some other point than at the fifth lumbar, especially at any sharp angle. For this reason, certain precautionary measures should be taken when the back is too flexible. Raising the arm will tensify the muscles attached to the spinous processes of the vertebræ as follows:

The trapezius connects with all the spinous processes of the thoracic region and supports them.

The origin of the latissimus dorsi muscle is from the spinous processes of the lower thoracic and lumbar vertebræ, and supports them.

The act of raising the arm will tense these muscles, and when they are tensed, it is almost impossible to cause any movement of any vertebra that is held by them. This will cause the force of the thrust to be spent on the last lumbar vertebra.

Sometimes a patient will not reach up with enough force to tense these muscles sufficiently to prevent movement of the vertebræ at some angle of the spine above the lumbo-sacral articulation. This may be overcome in the following manner:

The operator should stand to one side of the patient, and use the knee and that portion of the leg below it, to support the spinal column of the patient, as in Illustra-

tion, page 559. In this way there is no probability of any movement of any vertebra or of any articulation of the spine above the fifth lumbar vertebra.

5. Sacral Thrust Method. (See Illustration, page 563.)—The sacral thrust method is a very useful one to use in making an adjustment of the fifth lumbar vertebra of small children. As their spines are very flexible, it is hard to regulate the force of the thrust which passes down the entire length of the spinal column. Therefore we seek for a more direct and closer contact with the articulation that we wish to affect.

Position.—Lay the child on its back upon the adjustment table.

Straighten the limbs and flex them over its abdomen. In so doing, you can flex the sacrum where it articulates with the fifth lumbar, causing an outward angle, beyond normal, in this portion of the spinal column.

When the limbs are brought against the abdomen of the child, or nearly so, a thrust is given to the coccyx and sacrum at their lower end, which will open up the articulation between the sacrum and the fifth lumbar.

The point of contact is so close to the place that we desire to adjust, that we can regulate this adjustment much better in the case of a child, than we can by using the method that we use on a larger person or an adult.

6. Thumb Thrust Method, Lying.—As the patient lies upon the table, a lower extremity may be used as a lever, while the thumb is placed against the spinous process of the fifth lumbar vertebra.

A side movement, which tends to open up the fifth lumbar articulation, may be made more specific and more efficient by a thrust of the thumb on the spinous process of the fifth lumbar vertebra, pressing it one way, while the legs are rotated in the opposite direction.

This method has been described in connection with Lumbar Methods of Adjustment, in a previous chapter,

Sacral thrust method 5.

and for that reason we give but a brief mention of it in this chapter.

7. Thumb Thrust Method, Sitting.—This method of adjustment of the fifth lumbar has been described in the above chapter in connection with methods of adjusting lumbar vertebræ.

It is applied in the same manner, and the body is rotated in the same way, but it requires a little more skill on the part of the operator to successfully loosen up the articulation of the fifth lumbar vertebra with the sacrum. This method is used by the osteopathic profession, and no doubt with success in a great many cases. We do not use it, because we are more familiar and more expert in the use of other methods.

Most of the above methods that we have described, of adjustment of the different portions of the spinal column, are intended to be specific either with reference to a certain vertebra, or with reference to a certain region of the spine. We have methods that act generally upon the entire spine, and as a conclusion of this chapter we mention briefly some of the general methods of spinal treatment:

Extensions.—Traction or extension causes a general stretching of the musculature of the spine, and a thickening of the intervertebral tissues of the vertebræ.

Stretching may be done by swaying with the head in the halter, while the feet are strapped to the floor. In this way a general tension may be brought to bear upon the entire length of the spinal column. After a sufficient length of time and frequent repetition of this treatment, there will be a decided lengthening of the spinal column, because of a general increase in thickness of the intervertebral discs.

We also have stretching appliances in which the patient lies in the prone or dorsal position. The head and feet are both fastened. Tension is then made, while

the patient lies in comparative comfort. This tension is maintained or repeated until we have a permanent lengthening of the connective tissues and intervertebral tissues of the segments of the spinal column.

In the above methods, either by stretching in the upright position, or in the longitudinal position, the entire spinal column is affected.

If we desire to affect only the lumbar region and lower portion of the spinal column, we may do so by stretching from the arms, while the feet remain attached. Stretching in this way brings a most direct action, it seems, on the lumbar segments of the spinal column.

There is no doubt but what this stretching may be made more effective by continued and frequently repeated traction and relaxation. This may be done at almost any rate of speed if we have the proper apparatus. The increased traction and following relaxation may be repeated as often as 500 to 1,000 times per minute.

We have a vibratory table made with a provision of this nature, in our office, which is very effectual in increasing the height of patients who are treated thereon, which it does by relaxation of the musculature and increasing the thickness of the intervertebral cartilages.

For a detailed description of the effects and methods of spinal extension the reader is referred to Chapter I., Part Five.

PART SIX.

RAMIFICATION OF NERVES.

CHAPTER I.

CRANIAL NERVES.

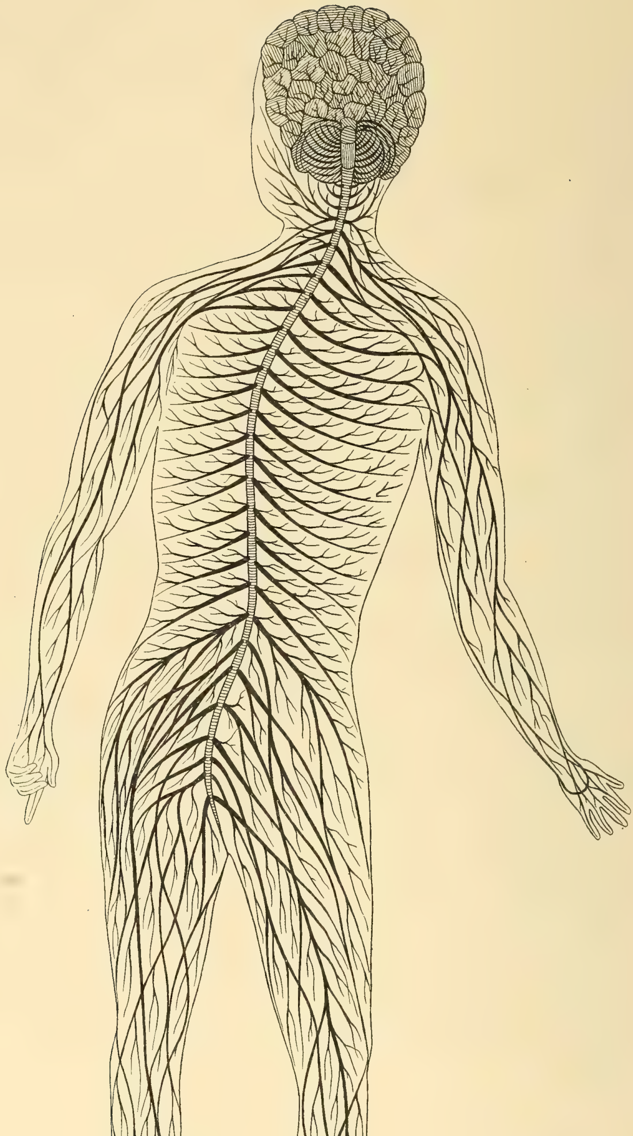
IN former chapters on the subject of nerve supply to the different organs and parts of the body, we have enumerated the principal nerves affecting, directly and indirectly, the viscera of the cavities of the head and thoracic, abdominal, and pelvic cavities collectively.

In this chapter we wish to study the subject of nerve ramification, by considering each of the different viscera and the cerebro-spinal nerves, which supply each of them directly, and also those which affect them indirectly.

We believe that by studying the nerve supply from two standpoints, namely: From the standpoint of the source of the nerve supply on the one hand, and the organs that are supplied by each pair of nerves, on the other hand, the student will gain a more comprehensive knowledge of the nerves and their relation to the organs they ramify and control.

There is no subject that is of more interest to us in spinal treatment, than is the subject of nerve supply to the various organs. For this reason we believe there is ample cause for presenting the nervous system from different standpoints that this subject may be more comprehensible.

One of our main reasons for presenting this subject in the way we do in this and in the following chapters, is that often we may detect nerves which are tender at their spinal exit, and it is necessary to have a comprehensive knowledge of the organs principally supplied by the nerve which is involved. This is necessary that we



Ramification of nerves.

may determine which organ is not functioning normally. This knowledge materially assists in both direct and differential diagnosis.

A competent knowledge of this subject is one of our greatest helps in differential diagnosis; especially is this true when there is a question as to which organ or internal viscus is involved in any pathological process.

Often organs which are adjacent receive their nerve supply from different segments of the spinal cord which are separated often by more or less space.

We will not be enabled to give a thorough and complete outline of the ramification of all the different nerves, as that would require considerable time and space, but we hope to give sufficient information concerning this subject to enable a person when detecting a nerve that is interfered with, to know which organ it most directly ramifies and supplies, and consequently involves. On the other hand, we hope to enable one to trace a nerve from a pathological lesion back to the spinal origin of the nerve which directly and indirectly supplies the organ involved and is responsible for the deranged function.

We will consider briefly the distribution and ramification of all the cranial and spinal nerves from the first cranial pair down to and including the fifth pair of lumbar nerves. We will first give attention to the ramification of the cranial nerves, and especially to the communicating branches of the spinal nerves which join them and exert an influence or materially affect their action.

We will pay but little attention to the sacral and coccygeal nerves, for the reason that they cannot be interfered with at their exit from the neural canal, because they pass through foramina formed of solid and immovable segments of bone, and because of the further fact that they cannot be interfered with except through interference with the dorsal or lumbar nerves which join them.

In this connection we wish to take up first a general consideration of the twelve pairs of cranial nerves from the standpoint more especially of the anastamotic branches which affect their functional activity.

We do not attribute so much importance to a study of the twelve pairs of cranial nerves from the standpoint of their origin, distribution and functional activity, as to a consideration of the functional control of these nerves by the communicating branches affecting them which are from the upper cervical and thoracic regions.

We have frequently demonstrated, in our clinical experience, that lesions of the spinal column in the cervical and in the thoracic regions, which interfere with the integrity of these spinal nerves, interfere also with the normal functioning of the cranial nerves which they join.

The fact that we have been able to restore hearing to the deaf, sight to the blind, and also to restore the function of taste and smell to those who have lost these functions, by relieving interference with the integrity of the upper cervical and thoracic nerves, proves conclusively that the functional activity of the cranial nerves is influenced and controlled by the communicating branches which they receive from these spinal nerves.

It is for the above reasons we wish to call the reader's especial attention to the communicating branches from the spinal nerves which join and affect the integrity of the cranial nerves.

There are many who know from experience which they have gained by correcting spinal lesions affecting the upper cervical and upper thoracic nerves, that such lesions do materially affect the functional action of the cranial nerves.

There has been a very indefinite idea extant as to the connection existing or the way in which the com-

municating branches reach the cranial nerves and control their functional phenomena.

This subject is not brought out definitely in our works on anatomy and physiology. But we wish to summarize the little that has been developed, discovered and written on this most important subject in a brief and comprehensive manner in this work.

OLFACTORY NERVES.

THE first pair of cranial nerves, or olfactory nerves, are responsible for the afferent function of smell, and disease or any lesions that affect the integrity of the function of these nerves cause a disease known as anosmia.

The olfactory nerves originate in three roots, the deep origin of which is as follows:

The first root is from the corpus striatum, superficial fibers of the optic thalamus and form convolutions of the Island of Reil.

The second root is from caruncula mammillaris and is connected by white fibers with the corpus striatum.

The third root is made up principally of longitudinal fibers of the gyrus fornicatus.

The superficial origin of the roots of the olfactory nerves is from the fissure of sylvius and the middle lobe of the cerebrum.

The second middle root is from the gray matter of the anterior lobe of the cerebrum.

The internal root consists of short white fibers which constitute the short root of this nerve, and comes from the inner part of the anterior lobe of gyrus fornicatus.

The exit of the olfactory nerves after their three roots have united is by way of the foramina of the cribiform plates of the ethmoid bones.

The olfactory nerve terminates in the mucous membrane of the nose and divides into some twenty branches.

The function of the olfactory nerves is that of smell. The integrity of the function of the olfactory nerves, though, depends upon the communicating branches which this pair of nerves receive from the upper cervical and upper thoracic nerves.

The connection of the cervical and also the upper thoracic nerves with the olfactory nerve is not clear, but the fact that such a connection does exist is clearly proven by the fact that we are enabled to restore the sense of smell to people who lose it, by relieving and removing the lesions that interfere with the integrity of the cervical and thoracic nerves which contribute communicating branches to the olfactory nerves.

We have restored the power of smell to patients who had suffered with complete anosmia several years, and have repeatedly done so by removing all spinal lesions interfering with the integrity of the spinal nerves which send communicating branches to the olfactory nerves.

The connection no doubt is made by way of the internal carotid plexuses of the sympathetic system.

Especially is this true of the connection between the superior thoracic nerves and the olfactory nerves.

The white rami of the upper thoracic nerves which join and help to form the upper stream of white rami communicantes all terminate in the superior cervical ganglia of the gangliated cords. The superior cervical ganglia, however, and the internal carotid plexuses which are just above them, are a continuation of the gangliated cords of the sympathetic. The superior cervical ganglia and the internal carotid plexuses jointly connect with all of the twelve pairs of cranial nerves.

Spinal impulses are carried by way of gray rami after they pass the superior cervical ganglia on the different cranial nerves.

The physiological impulses of spinal origin are transmitted to the olfactory nerves and they are directly responsible for their excitability and conductivity and their functional phenomena.

The communicating branches of the cervical nerves do not join the cervical ganglia of the sympathetic system, and do not in this way reach and communicate with the cranial nerves. They send their communicating branches into the terminal ganglia which are in relation with the cranial nerves and in this way communicate with them, and control their function.

The upper cervical nerves are no doubt responsible for the function of smell of the olfactory nerves to by far the greater extent; while the remaïnder of the activity of the olfactory nerves seems to be due to the communicating rami of the upper thoracic nerves through the upward stream of white rami communicantes and the superior cervical ganglia and internal carotid plexuses. The upper cervical nerves connect with the olfactory nerves by first joining the terminal ganglia.

OPTIC NERVE.

THE second pair of cranial nerves, or the optic nerves, are responsible for the power of vision, hence it is important that we understand the spinal connection of the nerves of the cervical and thoracic regions communicating with and controlling the function of the optic pair of nerves.

The optic nerves, strictly speaking, do not appear to be nerves in the ordinary sense. They seem to possess the power of the afferent transmission of the vibrations of light, back to the optical centers of the occipital lobe. This power, however, depends upon the integrity of the communicating branches from the cervical and thoracic nerves.

ORIGIN.

THE deep origin of the optic nerves is from the cortical portion of the occipital lobe, coming directly from the optic thalami, corpora geniculata, and corpora quadrigemina.

They pass from the brain through the optic commissure along the optic tract by two bands. Their exit from the cranium is through the optic foramina.

Their distribution is principally to the retina which they by division and expansion supply with numerous branches of ramification.

They first pierce the sclerotic and choroid coats at the back of the eyeballs, a little to the nasal side of the center, and then extend into and throughout the surface of the retina. The optic nerve function is that of vision. Disease of the optic nerve causes optic neuritis and general visual disturbance.

The upper thoracic nerves affect the optic nerves by way of the superior streams of the white rami communicantes and by means of the gray rami from the superior cervical ganglia which join the second pair of cranial nerves.

The superior cervical nerves send branches directly into the terminal ganglia affecting the optic pair of nerves. The terminal ganglia affecting optic nerves is the optic or ophthalmic ganglia of the sympathetic system.

The function of vision seems to be almost wholly due to the integrity of the upper cervical and upper thoracic nerves for the reason they send communicating branches directly and indirectly to the second pair of cranial nerves.

There is positive evidence of the influence of cervical and spinal nerves upon the power of vision of the optic nerves which is manifest when relieving interference with them.

We call attention to our clinical experience in which

we have been enabled to restore sight to eyes that were blind. We have been able to restore sight to eyes that were absolutely blind, in from three to four hours after adjustment, when the blindness was of recent origin. In cases that have been blind as long as from five to ten years we have been able to restore the power of vision in one week's time. Now we have restored the vision wholly by removing spinal lesions that interfered with the integrity of the nerves which send communicating branches to the optic nerve. These facts prove conclusively that optic nerve function is dependent upon the communicating branches which connect with it, from the spinal nerves.

This fact opens up a new field of thought to our physiologists and anatomists—one that is worthy of note, study and investigation—and we hope that much more light will be thrown upon this subject by future study and by subsequent investigation.

MOTOR OCULI.

THE third pair of cranial nerves or motor oculi furnish myomotor influences to the muscles of the eyeball. Diseases of this pair of nerves cause ptosis.

The origin of the motor oculi is principally from the floor of the aqueduct of Sylvius, and they receive fibers from the tubercula quadrigemina, valve of Vieussens, and their superficial origin is from the crus cerebri.

The exit of this pair of nerves is through the anterior sphenoidal fissures. The distribution of the motor oculi is as follows:

Superior division is to the superior rectus and levator palpebræ.

Inferior division is to the inferior rectus, internal rectus, and inferior oblique.

From the inferior oblique is a thick, short branch sent

to the lower border of the lenticular ganglion and it is supposed to be a motor root.

The function of this pair of nerves is myomotor. The oculi motor nerves rise by several roots which join and form one trunk. The common nerve trunk thus formed runs forward and slightly outward and is distributed to the dura mater near the posterior clinoid process and enters the cavernous sinus. It runs below the wall of the sinus and above and to the outer side of the internal carotid artery, and in this way it enters the sphenoidal fissure.

In this fissure it lies to the inner side of the abducens nerve in the angle formed by the tendinous origins of the internal and external rectus muscles. After passing into the orbit it divides between the two heads of the external rectus into two terminal branches, the smaller superior and the larger inferior division.

In the passage of the motor oculi nerve through the cavernous sinus and the sphenoidal fissure, they receive fibers from the sympathetic plexus which surrounds the internal carotid artery or the internal carotid ganglia of gangliated cords, and also receive a branch of communication from the ophthalmic division of the fifth pair of cranial nerves.

The superior division of the motor oculi runs along the outer side of the optic nerve and passes upward and ends by splitting into two branches, one branch supplying the superior rectus muscle of the eye, and the other branch supplies the levator palpebræ superioris.

The inferior division also passes at first on the outside of the optic nerve, but soon passes downward and gives off three branches in its course:

1. A long branch to the rectus inferior.
2. A short branch to the rectus internus.
3. A shorter branch to the ciliary ganglia.

The inferior division gives off branches which terminate in the obliquus inferior.

OPHTHALMIC GANGLIA.

THESE are small, flat, quadrilateral nodules, situated on the outer sides of the optic nerves; they are about one-third of an inch in front of the optic foramina. These ganglia are supposed to belong to the sympathetic division of the nervous system because they are composed of multiple cells of the sympathetic type.

Three important roots enter into or join the ophthalmic ganglion:

First, a branch from the inferior division of the motor oculi nerve.

Second, several distinct fibers from the nasal nerve join the ganglia.

Third, several fine filaments from the carotid plexus.

Sometimes there is also an inferior middle root from Meckel's ganglion.

The root from the motor oculi nerve is a little short root, while the one from the nasal nerve is a long root; the middle root is from the carotid plexus.

From the anterior border of the ophthalmic ganglia emerge the short ciliary nerves. They are usually five to ten in number. They surround the optic nerve and run almost parallel with it toward the eyeballs. These five to ten branches of the two nerves are arranged into the superior and inferior, external and internal branches; before they reach the eyeball they divide again into from ten to fifteen filaments on each side.

They then pass between the sclerotic and choroid coats to the ciliary bodies of the eye. These branches form a plexus which ramifies the entire ciliary bodies. This ganglion contains ganglionic cells and fibers to several points which originate from this ganglia as follows:

1. To the cornea.
2. Fibers to the ciliary muscles.
3. Fibers to the musculature of the iris.
4. Fibers to the vessels of the lachrymal glands.
5. Fibers which end between the muscles of the ciliary bodies.

From the above we see how nerves which send communicating branches to the ophthalmic ganglia may influence the functions of the cornea, the ciliary muscles, lachrymal apparatus and the ciliary bodies.

The nerves which send branches into and join the ophthalmic ganglia are from the upper thoracic and upper cervical region.

The anatomical parts supplied by the ophthalmic ganglia may receive impulses through this ganglia or from the superior cervical nerves by direct branches of ramification which join these ganglia. If from the superior thoracic nerves, then the impulses are by way of the white rami communicantes to the superior cervical ganglion and then through the internal carotid plexus to the ophthalmic ganglion. We have often been able to restore the power of compensation to the muscles of the eye and to correct refractive errors by removing spinal lesions that interfered with the integrity of the nerves which send communicating branches to the ophthalmic ganglia.

We hope to see a more thorough investigation along this line, which may be done in a clinical way by carefully testing the refractive errors of the eyes of cases treated, both before and after treatment.

CHAPTER II.

CRANIAL NERVES.

THE trochlear or fourth pair of cranial nerves are sometimes called the pathetic nerves.

Their deep origin is from the upper part of the valve of Vieussens immediately behind the testes.

Their superficial origin is from around the outer side of crus cerebri.

Their spinal exit is by way of the sphenoidal fissure, and these nerves occupy the highest position in the sphenoidal exit.

The pathetic nerves are distributed to the superior oblique muscles of the eye; they are the smallest pair of cranial nerves.

They also give off a recurrent branch to the tentorium cerebelli. This branch divides into three or four filaments and may be traced as far back as the walls of the lateral sinus in their passage from their origin.

Their superficial origin is from the outer side of the crus cerebri. They are first directed outward but they soon change to an inward and forward direction and wind round the crus cerebri and thus pass to and lie on the outer side of the optic nerves, and occupy a position between them and the abducens nerves.

They pierce the dura mater just outside of the posterior clinoid processes and near the attachment of the tentorium cerebelli.

They pass in a canal formed by the dura mater or along the superior angle of the cavernous sinus; in their further course upward they accompany the frontal and lachrymal nerves. They make their exit through the upper and outer parts of the sphenoidal fissures, then they ramify the superior oblique muscles.

This pair of nerves in their course extending along the cavernous sinuses receive communicating fibers from the sympathetic plexus which are formed around the internal carotid arteries.

They also receive communicating branches from the ophthalmic division of the fifth pair of cranial nerves. White rami communicantes from the upper thoracic nerves, which join the superior cervical ganglia, send impulses to the trochlear nerves by way of the internal carotid plexus of the gangliated cords of the sympathetic.

Impulses from the cervical spinal nerves are carried to the trochlear nerves by way of branches joining the trifacial nerves and the terminal sympathetic ganglia.

TRIGEMINAL NERVES.

THE trigeminal or trifacial nerves are the fifth pair of cranial nerves. They divide into three important divisions:

I. The Ophthalmic.
II. Superior Maxillary.
III. Inferior Maxillary.

I. THE OPHTHALMIC DIVISION.

THE ophthalmic division arises in its deep origin from the lateral tract of the medulla oblongata.

It divides into two roots and runs forward and enters the cavernous sinus and lies below the trochlear nerve, and external to the abducens nerve and separates it from the internal carotid artery.

In the sphenoidal fissure it divides into three terminal branches. It receives communicating branches from the internal carotid plexus and gives off fibers to the three nerves which enter with it into the muscles of the eye.

I. Nasal nerve.
II. Frontal nerve.

III. Lachrymal nerve.
IV. Nervus tentorii.

I. Nasal Nerve.—This branch of the nerve passes through the middle portion of the sphenoidal fissure, between the two bands or heads of the rectus externus muscle, and lies on the outer side of the abducens and motor-oculi nerves.

It then passes forward and inward in an oblique direction and crosses the optic nerve. It then passes to the inner surface of the superior oblique muscle, where it divides.

The branches of the nasal nerves are as follows:

1. Long ciliary nerve.
2. Infra-trochlear nerve.
3. Anterior ethmoidal nerve.
4. Long root of ciliary ganglia.

1. Long Ciliary Nerve.—This nerve consists of from two to four slender filaments, which join the short ciliary nerves from the ciliary ganglion, and together they enter the back of the eyeball.

2. Infra-trochlear Nerve.—This nerve passes along the outer inferior border of the obliquas superior, until it divides into the inferior and superior palpebral branches.

The superior branch supplies the inner canthus, the eyelid and the eyebrow.

The inferior branch supplies the lachrymal sac, conjunctiva, lower eyelid, and gives branches to the root of the nose.

3. Anterior Ethmoidal Nerve.—This nerve is a continuation of the nasal nerve; its cranial exit is the anterior ethmoidal foramen. It passes through the cribiform plate of the ethmoid bone and thus reaches the nasal cavity; in the nasal cavity this nerve divides into three branches:

(a) Internal nasal branches ramifying the anterior portion of the nasal septum.

(b) Anterior nasal branches ramifying the anterior portion of the lateral wall.

(c) External nasal branch; this is the largest branch and is a continuation of the anterior ethmoidal; this nerve ramifies and supplies the skin over the root and dorsum of the nose.

II. The Frontal Nerve.—The frontal nerve in its passage lies between the lachrymal and trochlear nerves; its cranial exit into the orbit is through the sphenoidal fissure. The frontal nerve passes forward; along the roof of the orbit it divides into three branches back of the eye and ramifies the levator palpebræ superioris.

The frontal nerve divides into three branches, as follows:

1. Frontal branch.
2. Supra-orbital nerve.
3. Supra-trochlear nerve.

1. The Frontal Branch.—This nerve supplies the internal parts of the forehead and anastomoses quite freely with the supra-orbital nerve.

2. The Supra-orbital Nerve.—This nerve passes in company with the supra-orbital artery through the supra-orbital foramen, and after piercing the orbicularis oculi muscle, it supplies the skin of the frontal region.

3. Supra-trochlear Nerve.—This is the smallest branch of the frontal nerve. This nerve passes out of the orbital cavity and supplies the skin and conjunctiva near the inner canthus. This nerve in its passage receives and gives off communicating branches to the infra-trochlear nerve

III. Lachrymal Nerve.—The lachrymal nerve is another division of the ophthalmic division of the tri-facial nerve. While passing through the orbit it runs along its roof, and along the upper border of the external rectus muscle in company with the lachrymal artery. It divides up into numerous branches which enter the

lachrymal gland. Some of these fibers supply parts of the gland and the secreting tubuli, while the other fibers pass through the gland and supply the skin and conjunctiva of the outer canthus.

The lachrymal nerve in its passage gives off a communicating branch to the zygomatic nerve before it enters the lachrymal gland. This branch runs downward and forward along the outer wall of the orbit.

IV. Nervus Tentorii.—This branch runs backward in close apposition to the trochlear nerve. In its passage it receives communicating branches from the sympathetic system by way of the internal carotid plexus.

The nervus tentorii supply the:

1. Tentorium.
2. Rectus sinus.
3. Petrosal sinus.
4. Transverse sinus.

II. SUPERIOR MAXILLARY DIVISION.

THE superior maxillary division of the trifacial or trigeminal nerve is larger than the ophthalmic division. This division of the trifacial nerve arises from the gray nucleus at the back part of the medulla, between the fasciculatus teretes and restiform columns, and the floor of the fourth ventricle.

This division passes through the superior maxillary bone by the foramen rotundum, from the skull cavity.

The superior maxillary division gives off the following branches:

1. Zygomatic nerve.
2. Spheno-palatine nerve.
3. Superior dental nerve.
4. Middle meningeal nerve.
5. External nasal branches.
6. Superior labial branches.
7. Inferior palpebral branches.

1. The Zygomatic Nerve passes through the spheno-maxillary fissure, along the outer wall of the orbit. It divides into the two following branches:

(a) Temporo-malar branch.
(b) Temporo-facial branch.

(a) The temporo-malar branch ramifies and supplies the skin of the temporal region and of the outer part of the frontal region.

(b) The temporo-facial branch ramifies and supplies the skin of the cheek and of the lower eyelid.

2. Spheno-palatine Nerves consist of two or three stout filaments which are given off in the pterygo-palatine fossa, which enter into the formation of a spheno-palatine ganglion.

3. Superior Dental Nerves consist of four or five filaments that are given off while they are passing through the infra-orbital canal.

The superior dental nerve divides into three branches, as follows:

(a) Middle superior dental nerve.
(b) Anterior superior dental nerves.
(c) Posterior superior dental nerves.

(a) The middle superior dental nerve is given off in the infra-orbital canal and joins the superior dental plexus.

(b) The anterior superior dental nerve leaves the main trunk before it emerges from the infra-orbital canal. This nerve also enters into the formation of a superior dental plexus. It also gives off a nasal branch which goes to the vestibulum nasi.

(c) The posterior superior dental nerve consists of two or three branches which are given off from the main trunk just as it enters the canal.

They supply the buccal mucous membrane and the last molar teeth of the upper jaw and the posterior or

alveolar foramina. Like the other branches they join into the formation of the superior dental plexus.

Branches of this nerve ramify and supply the gums and the teeth and are known as the rami dentales superiores; and also send fibers to the mucous membrane and lining of the antrum.

4. Middle Meningeal Nerve.—The middle meningeal nerve accompanies the middle meningeal artery and ramifies and supplies the dura mater.

5. External Nasal Branches.—These branches are all distributed to the alæ nasi.

6. Superior Labial Branches.—These branches consist of three or four large nerves which supply the skin and mucous membrane of the upper lip.

7. Inferior Palpebral Branches.—These nerves represent the external nasal branches and the superior labial branches, and branches of the infra-orbital nerve. They ramify the skin of the lower eyelid and communicate with the facial and infra-orbital nerve and plexus.

SPHENO-PALATINE GANGLION.
(Meckel's Ganglion.)

THIS ganglion is a minute, flat, triangular or quadrilateral ganglion, situated in the pterygo-palatine fossa. They are situated internally and somewhat below the superior maxillary division. This ganglion is evidently of the sympathetic system, as is determined by its microscopical appearance. This ganglion has three important roots:

1. A motor.
2. A sensory.
3. A sympathetic.

The motor root received by this ganglion is from the great superficial petrosal nerve.

The sensory root received by this ganglion is from the spheno-palatine nerve.

The sympathetic root received by this ganglion is from the great deep petrosal nerve.

The spheno-palatine or Meckel's ganglion gives off a number of branches which supply the mucous membrane of the heart and soft palate and nose. Most of these fibers are sensory in function.

The branches of Meckel's ganglion are as follows:

1. Orbital branches
2. Naso-palatine nerve.
3. Middle palatine nerve.
4. Anterior palatine nerve.
5. Posterior palatine nerve.
6. Posterio-inferior nasal branches.
7. Posterio-superior nasal branches (external).

1. The Orbital Branches supply the spheno-maxillary fissure, the ethmoidal cells, and the sphenoidal sinus.

2. Naso-palatine Nerve.—This nerve, together with the naso-palatine artery, supplies the nasal septum and the mucous membrane of that region.

3. Middle Palatine Nerve.—This nerve supplies the soft palate with sensation and also the azygos uvulæ and the levator palati muscles with motor fibers.

4. Anterior Palatine Nerve.—This nerve, together with the middle and posterior palatine nerves, passes through the ptergo-palatine canal. It supplies sensory nerve filaments to the hard palate. It gives off branches of communication to the naso-palatine nerve.

5. Posterior Palatine Nerve.—This nerve has a similar course to the middle palatine through the foramen and supplies the outer portion of the palate and the tonsil.

6. Posterio-inferior Nasal Branches.—They supply the middle and inferior turbinated bones and give a branch to the superior dental plexus.

7. Posterior-superior Nasal Branches. — The external one consists of from five to seven filaments and

supplies the posterior ethmoidal cells and the superior and middle turbinated bones. It also gives branches to the pharyngeal mucous membrane.

The internal branches of the above group supply the mucous membrane of the septum of the nose.

III. INFERIOR MAXILLARY DIVISION.

THIS constitutes the third division of the trifacial nerve. It is known sometimes as the mandibular division. This nerve is formed by the motor root from the trigeminus, and by branches from the gasserian ganglion of the sympathetic.

The inferior maxillary nerve receives two or three communicating filaments from the otic ganglion. The branches of the superior maxillary division are as follows:

1. Spinal branch.
2. Lingual nerve.
3. Masticatorious nerve.
4. Auriculo-temporal nerve.
5. The inferior dental nerve.

These branches give off branches as follows:

The lingual nerve gives off five branches:

1. Lingual branches.
2. Sublingual branches.
3. Rami sithmi faucium.
4. Two filaments to the submaxillary ganglion.
5. Anastomatic branches to the hypoglossal nerve.

The masticatorious nerve gives off the following branches:

1. Long buccal nerve.
2. Nerve to Masseter.
3. Deep temporal nerves.
4. Nerves to internal pterygoid.

The auriculo-temporal nerve gives off the following branches:

1. Parotic branches.
2. Anterior auricular branches.
3. Superficial temporal branches.
4. Branches to external auditory meatus.
5. Communicating branches to the facial nerve.

Inferior Dental Nerve.—

The inferior dental nerve is the largest branch of the inferior maxillary division. It splits up into terminal branches as follows:

1. Mental nerve.
2. Nerve to mylohyoid.
3. Inferior gingival branches.
4. Anterior inferior dental branches.
5. Posterior inferior dental branches.

The names of these nerves indicate clearly the part they supply.

The Sub-maxillary Ganglion.—

This ganglion is situated under the mucous membrane of the floor of the mouth, and between the lingual nerve and the sub-maxillary gland. This is a sympathetic ganglion, as is determined by microscopical examination.

It receives branches as follows: Two roots from the lingual nerve, third root from the sympathetic plexus maxillaris externus.

Otic Ganglion.—

This is a small oval ganglion situated just below the foramen ovale. This is probably also a sympathetic ganglion. Its roots are the filaments which join it to the trigeminal, facial, glosso-pharyngeal and sympathetic nerves.

Communicating branches are received from the following:

1. Superficial petrosal nerve.
2. Communicating with meningeal plexus.
3. Communicating with inferior maxillary division.

The first set above, the small superficial petrosal nerve, comes from the tympanic plexus which lies under the mucous membrane of the promontory of the tympanic cavity. It enters the skull cavities through the superior aperture of the tympanic canal, and receives branches from the genticulate ganglion of the facial nerve. It leaves the cranial cavities through a small foramen situated between the foramen ovale and foramen and enters the otic ganglion.

From the sympathetic ganglion, or plexus that surrounds the middle meningeal artery, several communicating branches are given to the otic ganglion. These constitute the communicating branches with the meningeal plexus.

The internal pterygoid nerve gives off two or three filaments which join the otic ganglion and form what is known as the communicating branches with the internal inferior maxillary division.

The Communicating Branches of the Otic Ganglion of the Motor Nerve.—

These branches may be enumerated as follows:

1. Small superficial petrosal nerve.
2. Anastomotic with cordi tympani.
3. Anastomotic with meningeal plexus.
4. Anastomotic branch with meningeal branch.
5. Anastomotic branch to the auriculo temporal nerve.
6. Anastomotic branch with inferior maxillary division.

CHAPTER III.

CRANIAL NERVES.

THE sixth pair of cranial nerves are called the abducen nerves, or the external oculo-motor nerves. They arise from the floor of the fourth ventricle, and their superficial origin is from the lower border of the pons varolii. They make their exit from the cranial cavity through the sphenoidal fissure, between the heads of the external rectus muscles, they supply the external rectus motor muscle of the eye.

As one of these nerves passes to lie between the internal carotid artery and the ophthalmic division of the fifth nerve it receives two or three filaments from the carotid plexus. After the nerve enters the sphenoidal fissure above the superior ophthalmic vein it receives communicating branches from the ophthalmic division of the fifth nerve.

Facial Nerves.—The facial or the seventh pair of cranial nerves rise from the floor of the fourth ventricle. Their superficial origin is from below the margin of pons varolii, lateral tract of the medulla oblongata and from the groove between the olivary and restiform bodies. They make their exit from the cranial cavity through the stylo-mastoid foramina. The facial nerves are the chief motor nerves of the face and head. They supply all the muscles of expression as follows:

1. Stapedius,
2. Stylohyoid,
3. Levator palati,
4. Azygos uvulæ,
5. Occipito frontalis,

and send branches to the spheno-palatine ganglion. The

facial nerves also contain motor and secretory fibers which enter into the geniculate ganglion.

The facial nerves have a number of connections with the sensory fibers of the trigeminal, pneumogastric and glosso-pharyngeal nerves.

The facial nerves divide into two important divisions, one is the upper facial division and the other is the cervico-facial division.

The principal branches of the temporo-facial division are:

1. Molar.
2. Temporal.
3. Infra-orbital.

The cervico-facial branch divides into three divisions:

1. Superior maxillary.
2. Inferior maxillary.
3. Cervical branches.

The branches given off by the facial nerves might be enumerated as follows:

1. Corda-tympani,
2. Buccal branches,
3. Temporal branches,
4. Cervical branches,
5. Zygomatic branches,
6. Nerve to stapedius,
7. Branch to digastric,
8. Mandibular branches,
9. Branch to stylohyoid,
10. Posterior auricular nerve,

and have communicating branches to the auricular branch or vagus.

The names of the branches of the nerves given above will indicate the parts they supply. In this connection we wish to consider briefly the geniculate ganglion. This is a ganglion composed of unipolar cells that are similar to the cells of a spinal ganglia. Situated on the end of

the horizontal portion of the facial nerve, this geniculate ganglion gives off two important nerves:

1. The communicating branch to the tympanic plexus.
2. Two great superficial petrosal nerves to Meckel's ganglion.

Auditory Nerve.—Auditory or acoustic nerves are the eighth pair of cranial nerves. They originate principally from the anterior walls of the floors of the fourth ventricles. Their superficial origin is from around the restiform bodies.

Exit.—The cranial exit of an acoustic nerve is through the meatus auditorius internus.

Distribution.—The distribution of the eighth pair of cranial nerves is through the following branches:

1. Vestibular nerve.
2. Cochlear nerve.

The vestibular nerve lies within the internal auditory meatus in close apposition to the following, and divides, at the fundus of the meatus, into its terminal branches.

Its branches are as follows:

1. Uticulate nerve.
2. Superior ampullary nerve.
3. Inferior ampullary nerve.
4. External ampullary nerve.

The cochlear nerve divides into a number of filaments before entering the central canal. Several filaments form a plexus and the ganglion of Corti. This ganglion also has bipolar cells.

The branches of the cochlear nerve are as follows:

1. Sacular nerve.
2. Trochlear nerve.

Glosso-pharyngeal Nerves.—The glosso-pharyngeal nerves are the ninth pair of cranial nerves. A glosso-pharyngeal nerve is a mixed nerve containing both afferent and efferent fibers.

The deep origin of the glosso-pharyngeal nerve is

from the nucleus of gray matter situated at the lower part of the floor of the fourth ventricle, and external to the fasciculi teretes, the superficial exit from the cranial cavity or the nose.

The superficial origin of the glosso-pharyngeal nerves is from the upper part of the medulla oblongata, just behind the olivary bodies.

Exit.—The exit of the glosso-pharyngeal nerve is through the central part of the jugular foramen, and upon it are two ganglionic enlargements: the superior and the smaller; the inferior and the larger.

The function that is supplied and controlled by this nerve is that of taste which nerve is supplied to the tongue.

The branches of the glosso-pharyngeal may be enumerated as follows:

1. Carotid branches.
2. Lingual branches.
3. Muscular branches.
4. Tympanic branches.
5. Tonsillar branches.
6. Pharyngeal branches.
7. Stilo-pharyngeal branches.

The ganglionic enlargements are:

1. The ganglion superioris.
2. The Petrous ganglion.

Both of these ganglion are composed of unipolar cells, and they are considered true cerebro-spinal ganglion.

The names of the branches of the pharyngeal nerves sufficiently indicate the parts that they supply.

We might mention in this connection, however, that the tympanic nerve divides up into three branches:

1. Twigs of the tympanic to mucous membrane.
2. Small superficial petrosal nerves to otic ganglion.
3. A branch to the mucous membrane of the eustachian tube.

Vagus Nerves.—The vagus or tenth pair of cranial nerves are also known as the pneumogastric nerves. These nerves are mixed, containing both afferent and efferent fibers, and also receive communicating branches from the sympathetic.

The pneumogastric nerves are the principal motor nerves to the stomach, lungs, esophagus, heart, and all the viscera of the thoracic, abdominal and pelvic cavity. They convey fibers which supply and regulate the movements of the heart, bowels, and other viscera of the trunk.

These nerves are supposed to furnish the secretory impulses to the stomach and also to the kidneys.

The pneumogastric nerves have their deep origin from the floors of the fourth ventricles.

The superficial origin of the pneumogastric nerves are from a number of filaments from the lateral tracts of the medulla oblongata behind the olivary bodies below the origin of the glosso-pharyngeal nerves. Their superficial origins are by the same sheaths as the spinal accessory nerves through the jugular foramina.

There are two ganglion given off from each of these two pair of nerves:

1. Superior jugular ganglion or ganglion of the root of pneumogastric.
2. Inferior jugular ganglion or ganglion of trunk of the pneumogastric.

The Jugular Ganglion.—This is a small ganglia composed, like the ganglion nordosum, of unipolar cells of the posterior root and of the ganglionic type.

This ganglion receives communicating branches from the superior cervical ganglion of the sympathetic, and sends a twig to the spinal accessory nerve, and also has other branches:

1. Auricular branches.
2. Meningeal branches.

1. The auricular branches pass along the anterior surface to the mastoid canal. They cross the facial nerve and appear just behind the styloid foramen. A lower branch of each joins the posterior auricular branch of the facial nerve, while an upper branch ramifies the posterior surface of the external auditory meatus. These nerves thus communicate, as already described, with the facial nerve, and glosso-pharyngeal.

Ganglion Nordosum.—This is much larger than the jugular, about an inch long and one-fifth of an inch broad. This ganglion lies behind the internal carotid artery, and in front of the superior cervical ganglion. By slender filaments it is connected with the superior cervical ganglion, and with the hypoglossal nerve.

From the ganglion of Nordosom we have two important branches:

1. Pharyngeal branches.
2. Superior laryngeal branches.

The superior laryngeal branches are divided as follows:

1. The external branch.
2. The internal branch.

1. The external branch ramifies especially the mucous membrane of the vocal chord.

2. The internal branch supplies the laryngeal mucous membrane.

The principal branches given off from the trunk of the pneumogastric nerve are as follows:

1. Gastric branches.
2. Esophageal branches.
3. Superior cardiac branches.
4. Recurrent laryngeal nerve.
5. Anterior bronchial branches.
6. Posterior bronchial branches.
7. Branches to the hypogastric plexus.

The gastric branches of the pneumogastric are sup-

plied to the superior and posterior surfaces of the stomach, and also supply the liver and the spleen.

The recurrent meningeal branches are very important, and give off a number of branches as follows:

1. Tracheal branches.
2. Esophageal branches.
3. Inferior cardiac branches.
4. Anterior branch to recurrent meningeal nerve.
5. Posterior branch to recurrent meningeal nerve.

The names of the nerves above sufficiently indicate the parts that are supplied; therefore we pass them without much comment.

Spinal Accessory Nerves.—This is the eleventh pair of cranial nerves. They are supposed to be purely motor nerves. The larger portion of the fibers forming these nerves comes from the spinal cord. Their deep origin is from the nucleus of the gray matter at the back of the medulla oblongata below the vagii. Their exit from the cranial cavity is through the jugular foramina, while their roots of origin enter the cranial cavity through the foramen magnum.

There are branches of communication between the second, third, fourth, and fifth cervical nerves and the spinal accessory nerves.

The spinal accessory nerves assist in the formation of the cervical plexuses, and occasionally give fibers to the formation of the great auricular nerves and join the posterior branches of the spinal nerves.

The Hypoglossal Nerves. (The twelfth pair of cranial nerves.)—Their deep origin is from the gray nucleus in the floor of the fourth ventricle on the upper portion of the medulla oblongata. Their superficial origin is from ten to fifteen filaments from grooves between anterior pyramid and olivary bodies.

The twelfth pair of nerves receive communicating

branches from the first and second cervical pair of nerves, and give off three important branches:

1. Lingual branches.
2. Meningeal branches.
3. Descendens hypoglossi.

The terminal branches of the hypoglossal nerves supply the muscles of the tongue. They are anastomosed freely with the terminal branches of the lingual nerve.

The meningeal branches leave the trunk in the condoloid foramen and pass backward to the occipital bone.

Descendens hypoglossi is formed partly by fibers from the first three cervical nerves. The first cervical nerves pass horizontally forward to the hypoglossal. One branch from the second cervical unites with one from the third cervical, thus forming a long loop.

CHAPTER IV.

CERVICAL NERVES.

THE cervical nerves are very apt to become involved and interfered with as a result of contracture of the musculature of the cervical region.

The cervical region is exposed, more or less, to the changes of the atmosphere, and also to excessive movement that may irritate or injure the articular ligaments, and thus produce contractions that will narrow the intervertebral foramina.

We have in all, eight pairs of cervical nerves, any of which may be interfered with at their places of exit from the neural canal, but at no other portion of their route of distribution can they be impinged, because at no other point do they pass between movable tissue as resistant as is nerve itself, and for further reason that the nutrition of these nerves at their spinal exit can be interfered with, as they receive their nourishment in the spinal centers.

Spinal lesions, therefore, in the cervical region, and in all other regions, may affect the nerves by mechanical interference, or by occlusion of the nutrient supply to their centers.

SUB-OCCIPITAL NERVES.—The first pair of cervical, or sub-occipital nerves, make their exit from the neural canal between the occipital bone and the atlas.

They make their exit through a groove in the superior portion of the posterior arch of the atlas, just back of the condyloid articulations of the atlas with the occipital bone.

These nerves are accompanied and contained in a sheath with the vertebral arteries, veins and the gray rami of the vertebral plexus of the sympathetic. The

branches from the fourth vertebral plexus and the vertebral arteries and veins control the metabolic process, and also control the nourishment and drainage of the posterior portion of the brain.

This pair of nerves may be, and are frequently interfered with, either directly or indirectly, by lesions of the occipito-atlantal articulations. Lesions of these articulations interfering with the nerves have been termed by many, subluxations. They are of much more frequent occurrence than is commonly supposed, and especially is this true in people of advanced years.

The most common lesions, narrowing the foramina, and thus causing an interference with the passage of the suboccipital nerves, are contractions of the musculature which will approximate the posterior arch of the atlas to the occipital bone, thus affecting the foramina, or passages of the nerves and nutrient vessels from the neural canal.

The contractions may be unilateral.

Unilateral contractions may produce conditions which appear to be malpositions of the atlas with relation to the occipital bone. From palpation we discover apparent malpositions, which might be enumerated under the following headings:

1. Lateral condition.
2. Anterior condition.
3. Posterior condition.
4. A twisted condition.
5. An approximated condition.

The cause of the anterior condition undoubtedly would be some contraction of the anterior common ligament, and of the anterior muscles of this region. This we believe to be a very rare condition and one that is seldom liable to occur, because of the fact that we have about ten times as much muscular tissue on the

posterior, as we have on the anterior portion of this union between the occipital and the atlas.

Posterior Condition.—The posterior condition would be more probable than the anterior condition, because of the excess of quantity of muscle tissue, comparatively, of the posterior portion of this region.

A mere contraction of the posterior muscles would raise the back portion of the arch of the atlas and draw the transverse processes posterior, especially at their inferior border. The posterior condition, combined with the contracted condition, would make a decidedly detrimental lesion affecting the integrity of the suboccipital nerves.

Lateral Condition—The lateral condition may occur by reason of the contraction of the musculature upon one side of the segment, If the contraction should be on both sides, we would have merely a matter of uniform approximation, but should one side be affected mostly, then a unilateral contraction would produce a lateral condition, apparently, of the atlas with relation to the occipital bone.

Twisted Condition.—This condition is perhaps rare, and would be the result of considerable violence to the patient's head. This would imply a backward or forward condition of one articulation, combined with no movement, or an opposite movement of the opposite condyloid articulation between the atlas and occipital bone.

Approximated Condition.—This condition is no doubt the most common of all of the lesions of the occipito-atlantal articulations, involving the integrity of the suboccipital nerves.

The approximated condition when unilateral, is responsible for the apparent lateral subluxations. When the contraction, however, is uniform on all sides, then we have simply a matter of contraction and uniform

approximation. There is no doubt that this is the condition with old people, which comes with the settling and general stiffening and contraction which ensues with age.

There is a difference in the depth of the groove just back of the condyloid articulations in the arch of the atlas. In some cases, this groove is so deep that no amount of approximation will interfere materially with the nerve sheath, and with the nutrient vessels accompanying the suboccipital nerves.

In some cases, instead of the suboccipital nerve sheath and its contents passing over the posterior arch of the atlas, they pass through a solid foramen formed in the posterior arch of the atlas. In such cases, atlas lesions would be of but little importance, and the correction of the atlas lesions by relaxation of the musculature, would in such cases accomplish no good whatever.

As a result of a deep groove or of a solid foramen in the posterior arch of the atlas, the suboccipital nerve sheath and its contents are free from interference. In such cases, people are free from neuralgic headaches, and also such people will retain their memory as age advances, better than the people who have shallow grooves for the suboccipital nerves which permit of nerve interference and of occlusion of the drainage and nutrient vessels which supply the posterior portion of the brain.

The test given in a previous chapter, which consisted of the patient standing erect and looking at an object directly overhead, is a convenient way of testing the condition of the occipito-atlantal articulations. Any interference with the movement of the head in looking directly overhead, would be evidence of lesions of these articulations on one or on both sides.

Painful and restricted forward and backward movements of the head are especially indicative of posterior or anterior subluxation of the atlas.

When the suboccipital nerves are interfered with and are impinged and tender, you will find tenderness over the rudimentary process, and also abnormal positions of the transverse processes, and you will find contracture of muscles attached to the occipital bone and the spinous processes of the cervical vertebræ.

The most common derangement caused by abnormal approximation of the occiput and the posterior arch of the atlas, is either an anæmic or a congested condition of the circulation of the posterior portion of the brain.

We have vertebral arteries supplying the posterior portions of the brain and the vertebral veins, the principal vessels of drainage of the same portion. It is because of pressure on these vessels caused by atlas lesions, that we have interference with the nutrition and drainage of the posterior portion of the brain.

If the impingement of the blood vessels interferes more with the arteries that supply blood to the brain, than with the veins that drain it, then there will be an anæmic condition thereof. On the other hand, if the veins are compressed most, then the posterior portion of the brain will become congested. This condition is by far the most common and the most frequent cause of those full, throbbing, and congested headaches which are so often complained of by so many people.

When the vertebral arteries supplying nutrition, and veins supplying and draining to the posterior portion of the brain, are interfered with, the results are far reaching and the effects are marked, because of the disturbance of the circulation and nutrition of the brain. This condition alters the functions of the centers that control the generation and transmission of the nerve force that produces vital action in all parts of the body, and also causes alteration and derangement of all automatic nerve action of the sympathetic portion of the nervous system throughout the entire body.

In relation with the atlas, we have also the suboccipital nerves, the gray rami, the superior cervical ganglion of the sympathetic system, and the superior vertebral plexuses and nerves to the walls of the vertebral arteries. These nerves also send nutrient or trophic branches to the mastoid cells and occipito-atlantal articulations.

They join the second cervical nerves and help to form the recurrent nerves, and are thus distributed to the meninges of the brain and upper portion of the spinal cord, and to the vertebral articulation of the upper cervical vertebræ.

They connect, by direct communication, with the vertebral plexus, the ninth cranial nerve, tenth cranial nerve, twelfth cranial nerve, and the meningeal nerves.

The suboccipital nerves receive branches of communication from other nerves and ganglia as follows:

1. Second pair of cervical nerves.
2. The superior cervical ganglia.
3. Branch of vagus to first and second cervical.

Impingement of the suboccipital nerves, then, may cause quite a diversity of ailments of the cephalic organs; may cause loss of memory, dullness of mental powers; in fact, general derangement of the mental faculties. Insanity may come from abnormal function of nerves, or from alteration of the nourishment and drainage of the encephalon, due to interference with the integrity of the first cervical or suboccipital pairs of nerves.

All functional action of the organs of the body may and do become more or less impaired because of a congested or an anæmic condition of the brain, which contains nerve centers for the origination, reception and transmission of nerve impulse to all parts of the system.

The suboccipital nerves by joining the pneumogastric nerves affect their integrity. Interference with them, therefore, will and does affect the integrity of the functional activity of the pelvic cavity.

The principal viscera affected directly by the pneumogastric and indirectly by the suboccipital nerves are the following:

Ears.	Heart.
Larynx.	Liver.
Pharynx.	Stomach.

Intestines, etc.

And all the viscera of the cavities of the trunk.

From suboccipital impingement and nutritive derangement of the brain we may get such ailments as:

Iritis.	Delusions.	Hardened ear wax.
Vertigo.	Dizziness.	Polypi of the ear.
Abscess.	Retinitis.	Buzzing in the ear.
Delirium.	Pterygium.	Ringing in the ear.
Epilepsy.	Drowsiness.	Catarrh of the ear.
Cataract.	Depressions.	Optic nerve atrophy.
Glaucoma.	Conjunctivitis.	Softening of brain.
Apoplexy.	Loss of memory.	Neuralgic headaches.
Otorrhea.	Mental dullness.	Running from the ear.
Keratitis.	Tumors of brain.	Conjugate deviations.

Impingement of the suboccipital nerves will cause an interference with the nerve supply to the scalp, and also the meninges of the brain, and the same will cause neuralgic headaches, especially those of the front of the head or forehead, and around and over the orbit of the eye. Many headaches may be stopped by an adjustment of the atlas.

Motor disturbances of the eye and its appendages result from lesions that hinder the origin of the motor impulses or transmission of them to the eye. Impulses from the spinal cord pass through the cavernous plexus from the superior cervical ganglion to the eye and its appendages. Atlas lesions interfere with the free transmission of these impulses; these atlas lesions may interfere by direct pressure of the bony parts upon the nerves and blood vessels, or by muscular or ligamentous

contractions or a tightening of the adjacent tissues, and a consequent pressure upon vessels or nerves or ganglia.

By spinal adjustment the writer has demonstrated that both trophic and motor impulses travel from the spinal cord to the cranial nerves. This has been done by opening the channels for the spinal exit from the neural canal, and in this way we have restored power of function to the optic and auditory nerves. These impulses may pass by way of the superior cervical ganglion and the cavernous plexuses of the sympathetic nervous system.

Muscles receiving nerve supply from the first cervical or suboccipital pair of nerves:

1. Complexus.
2. Superior oblique.
3. Rectus capitis laterals.
4. Rectus capitis anticus major.
5. Rectus capitis anticus minor.
6. Rectus capitis posticus major.
7. Rectus capitis posticus minor.

Second Pair of Cervical Nerves.—This pair of nerves make their exit from between the lamina of the atlas and the pedicles of the axis through the foramina formed by notches in the parts named.

The second pair of cervical nerves receive communicating branches from the first pair of ganglia of the sympathetic system from the first and the third pair of cervical nerves. They contribute branches to the formation of the following nerves and some of these nerves are mostly formed from the second pair of cervical nerves.

1. Small occipital.
2. Third occipital.
3. Auricular nerves.
4. The great occipital.
5. Great auricular nerves.
6. Posterior auricular nerves.

They send branches to the mastoid cells and help to form the loop between the first and the second pairs of cervical nerves.

They supply the back of the head as far forward as the vertex, the sides and front of the neck to the chin and to the sternum, the external ears, and communicate with the facial nerves or with the terminal ganglia associated therewith.

They supply the following muscles:

1. Splenium.
2. Trapezius.
3. Complexus.
4. Auricular.
5. Trachelo-mastoid.
6. Occipito-frontalis.
7. Sterno-cleido-mastoid.

These nerves ramify some of the nerves and parts, as the suboccipital nerves and some of the malfunction arising from the impingement of them is similar to that coming from interference with the suboccipital nerves.

Third Pair of Cervical Nerves.—This pair of nerves make their exit from the neural canal between the pedicles of the axis and the pedicles of the third cervical vertebra. They communicate with the second and fourth pair of cervical nerves, and receive gray rami communicantes from the superior cervical ganglia of the sympathetic system and they help to form the superior cervical plexus in connection with the first, second, and fourth pairs of cervical nerves. They help in the formation of the small occipital and the great auricular nerves, and they contribute anastomotic branches to the formation of the phrenic nerves.

They supply motor impulses to the:

1. Trapezium.
2. Longus colli.
3. Scalenus medium.

4. Trachelo mastoid.
5. Multifidus spina.
6. Rectus anticus major.
7. Levator anguli.
8. Scapular sterno-cleido-mastoid.

They also supply sensation to the sides and front of the neck and the scalp, back of the ear.

Impingement of the third pair of cervical nerves affects musculature contraction, the sensory integrity of the organs of special sense and the diseases of the eye and ear and mucous membrane of the nose and fauces.

Impingements impairing the integrity of this pair of nerves which distribute the accelerator impulses to the heart and exert a vasoconstrictor effect on the lungs. Excessive or efficient action of the sweat and sebaceous secretions and disorders of the face are produced by interference with these nerves. Such diseases as neuralgia of the face, teeth, jaws and gums, dull headaches, catarrh, polypi, tumors of the nose, cheeks and lower jaws, and contraction of the muscles of the neck, may result from pressure on the third pair of cervical nerves.

The Third Cervical Nerves.—The third pair of cervical nerves pass from the neural canal between the pedicles of the axis and the third cervical vertebra. This pair of nerves send communicating branches to the second and fourth pair of cervical nerves. They also join into the formation of the superior cervical ganglia.

They contribute branches to the formation of the small occipital, the great auricular nerve, and also give off an auxiliary branch to the formation of the phrenic nerve and send communicating branches to the hypoglossal nerves.

This pair of nerves receives communicating branches from the second and from the fourth pair of cervical nerves and also gray rami communicantes from the

superior cervical ganglia of the sympathetic system or cords.

The muscles supplied by the third pair of cervical nerves partly or entirely are as follows:

1. Trapezius.
2. Longus colli.
3. Scalenus anticus.
4. Multifidus spinæ.
5. Rectus anticus major.
6. Sterno-cleido-mastoid.
7. Levator anguli scapulæ.

The third pair of cervical nerves send branches of ramification by way of the occipital nerves into the region of the scalp posterior to the ears. The integrity of the function of the ears, the eyes, mucous membranes of the nose and pharynx are disturbed by interference with the nerves.

This pair of nerves exerts a vasoconstrictor influence upon the lungs and an accelerator influence upon the heart. These nerves are usually involved in skin disorders, such as pimples, eruptions of the skin, and affect the skin of the face and neck.

These nerves join the terminal ganglia of the sympathetic, and thus affect the sebaceous and sweat glands of the face. These nerves are usually involved in cases of catarrh, nasal polypi, tumors of the nose and diseases of the teeth and gums.

The ramification of these nerves is very nearly the same as that of the fourth pair of cervical nerves. In all cases of catarrhal infection of the nasal passages particular attention should be given to any lesions that would involve the integrity of the third pair of cervical nerves.

Fourth Pair of Cervical Nerves.—The fourth pair of cervical nerves make their exit from the neural canal between the pedicles of the third and fourth cervical

vertebræ. They give off branches to the third and fifth pair of cervical nerves and also help in the formation of the cervical plexus.

They receive communicating branches from the third and fifth pair of cervical nerves and also gray rami communicantes from the superior cervical ganglia of the sympathetic.

The fourth pair of cervical nerves are what we might consider central place in the cervical region. They contribute most of the fibers that enter into the formation of the phrenic nerves. The phrenic nerves, however, receive auxiliary branches from the third and fifth pair of cervical nerves.

The fourth pair of cervical nerves are very important for the reason of their influence upon the lungs, upon the heart, supplying, as they do, the pluræ, the pericardium and the diaphragm; they also enter into the formation of the solar plexus and their fibers are traced as low as the supra-renal capsules of the kidneys.

These nerves also have an important influence upon some of the organs of the cephalic region.

The muscles partially supplied by the fourth pair of cervical nerves are as follows:

1. Trapezium.
2. Complexus.
3. Semi-spinalis.
4. Scalenus medius.
5. Supra-clavicular.
6. Inter-transversales.
7. Transversales cervices.
8. Levator anguli scapulæ.

The ramification of these nerves is quite extensive. They ramify the pharynx, the alveolar arches of the upper and lower teeth, and the upper end of the trachea, and they also send filaments to the brachial plexus and to its parts. They supply the pericardium, pluræ and the

diaphragm and ramify some of the small intestines and supra-renal capsules of the kidneys.

A number of ailments may result from an involvement affecting the integrity of this pair of nerves: nasal catarrh, nasal polypi, nosebleed, barber's itch, and all diseases of the teeth. Since the fourth pair of nerves especially supply and have to do with the pupil of the eye and sight of the eye, such diseases as amaurosis, far sight, near sight, color blindness, etc., ensue as a result of interference with the fourth pair of cervical nerves.

The fourth pair of cervical nerves control the function of contraction and expansion of the pluræ and the diaphragm and have much to do with the circulation within the lungs. For this reason adjustment of the fourth cervical nerves will relieve most all forms of congested headaches, which relief seems to be due to the equalization of the circulation of the thoracic and the cranial cavities.

Nine-tenths of all headaches may be relieved almost instantly by a fourth cervical adjustment to relieve or stimulate the fourth pair of cervical nerves.

We have been enabled to restore a normal condition of the mind in cases of insanity by an adjustment of the fourth pair of cervical nerves. We have also been able to relieve certain lung affections and infections of the respiratory tract.

Stimulation of the fourth pair of cervical nerves is an important measure in the resuscitation of patients who have sometimes fallen with sudden unconsciousness.

Percussion over this region will cause vasoconstriction upon the lungs and is an auxiliary measure in controlling hemorrhage in pulmonary conditions; in disease of the gums, as alveolar pyorrhea. Relief of the fourth cervical nerves by removing all interference with their function is a positive cure for diseases of the teeth and gums.

Percussion over the spinous processes of the fourth

and fifth cervical vertebræ is the best method of stimulation used in restoring patients from loss of consciousness or heart failure.

Fifth Cervical Nerves.—The fifth pair of cervical nerves are larger than the fourth. They give branches to the fourth and sixth pair of cervical nerves. They also receive branches from the fourth and sixth pair of cervical nerves and gray rami from the middle cervical ganglion of the sympathetic system. They help supply the following muscles:

1. Biceps.
2. Deltoid.
3. Splenius.
4. Complexus.
5. Serratus magnus.
6. Pectoralis major.
7. Multifidus spinæ.
8. Scaleni and teres major muscles.
9. Trachelo mastoid and branches to the shoulder.

The fifth pair of cervical nerves send branches directly into the formation of the brachial plexuses which supply the upper extremities.

The fifth pair of cervical nerves give off branches to the formation of the long posterior thoracic nerves. Involvement of the fifth pair of cervical nerves may interfere with the integrity of the upper extremities or with the respiratory muscles of the chest.

Impingement or interference with the fifth pair of cervical nerves may also involve the lungs, heart, diaphragm, pericardium, etc., because of the auxiliary branch of the fifth pair of cervical nerves which enter into the formation of the phrenic nerves. The fifth pair of cervical nerves ramify the following muscles:

1. Biceps.
2. Deltoid.
3. Subclavius.

4. Terres minor.
5. Terres major.
6. Supraspinatus.
7. Infraspinatus.
8. Serratus magnus.
9. Pectoralis major.
10. Brachialis anticus.
11. Rhomboideus minor.
12. Rhomboideus major.

The fifth pair of cervical nerves send branches of ramification into the esophagus, upper trachea, and bronchial tubes. They ramify the thyroid glands and for this reason affect materially the entire system. This is owing to the influence of the colloid secretion of the thyroid glands. It is claimed by some that adjustments freeing and stimulating the action of the thyroid glands is especially helpful in the treatment of infectious diseases or any condition of lowered vital activity or lack of auto-protection.

The Sixth Cervical Nerves.—The sixth pair of cervical nerves make their exit from the neural canal between the pedicles of the fifth and sixth vertebræ. They give off branches to the fifth and seventh pairs of cervical nerves and receive communicating branches from the same pair of nerves and also gray rami communicantes from the middle cervical ganglia of the sympathetic system.

This pair of nerves enter into the formation of the brachial plexus and help in the formation of the thoracic nerves. They also give off communicating branches to the circumflex, the subscapular, median muscle, cutaneous and muscle spiral, supra scapular, anterior and long posterior thoracic nerves. They supply the skin over the deltoid, and radial side of the arm and forearm, and to the back of the neck, and they penetrate and help to supply the following muscles:

1. Biceps.
2. Triceps.
3. Deltoid.
4. Subclavius.
5. Lumbricales.
6. Terres minor.
7. Terres major.
8. Subscapularis.
9. Infraspinatus.
10. Supraspinatus.
11. Supinator longus.
12. Adductor pollicis.
13. Oppenens pollicis.
14. Brachialis anticus.
15. Pronator radii terres.
16. Flexor carpi radialis.
17. Supinator radii brevis.
18. Extensor brevis pollicis.
19. Extensor carpi radialis brevior.
20. Extensor carpi radialis longior.

These nerves help to supply and have an influence upon the thyroid gland, esophagus, upper trachea, and bronchial tubes.

Seventh Cervical Nerves.—The seventh pair of cervical nerves pass from the neural canal above the pedicles of the seventh and between them and the pedicle of the sixth cervical vertebra. This pair of nerves give communicating branches to the sixth and eighth pair of cervical nerves and receive communicating branches from the sixth and eighth pair of cervical nerves and from the inferior ganglion of the sympathetic system. The seventh pair of cervical nerves enter into the formation of the brachial plexus, also they affect the thyroid glands, trachea, bronchial tubes, esophagus, and any impingement of these nerves that involve their

integrity may interfere with the muscles of the arm, muscles of the chest, and the muscles of respiration.

The muscles supplied by the seventh pair of cervical nerves are as follows:

1. Subscapularis.
2. Serratus magnus.
3. Extensor indicis.
4. Coraco-brachialis.
5. Extensor minimi digiti.
6. Extensor carpi ulnaris.
7. Extensor longus pollicis.
8. Extensor communis digitorium.
9. Extensor carpi radialis brevier.
10. Extensor carpi radialis longior.
11. Extensor ossi metacarpi pollicii.

Involvement of the seventh pair of cervical nerves will cause affection of the trachea, larynx, esophagus, and organs of voice.

Eighth Pair of Cervical Nerves.—The eighth pair of cervical nerves make their exit from the spine between the pedicles of the seventh cervical and the first dorsal vertebræ. They also receive communicating branches from the seventh and the first thoracic pair of nerves. They receive gray rami branches from the inferior cervical ganglia of the sympathetic. The eighth pair of cervical nerves have a decided influence upon the organs of voice, affect the trachea, the bronchial tubes, larynx, pharynx, and help in the formation of the brachial plexus.

Any involvement of the eighth pair of cervical nerves affects the integrity of the musculature of the upper extremity. They also contribute to the formation of the nerves which supply the muscles of expiration. The eighth pair of cervical nerves send branches of ramification into the following muscles:

1. Triceps.
2. Anconeus.
3. Lumbricales.
4. Sub-scapularus.
5. Palmaris brevus.
6. Palmaris longus.
7. Palmer interossi.
8. Dorsal interossi.
9. Pectoralis minor.
10. Pectoralis major.
11. Flexor profundus.
12. Brachialis anticus.
13. Pronator quadratus.
14. Flexor longus ulnaris.
15. Oppones minimi digiti.
16. Flexor longus pollicis.
17. Abductor minimi digiti.
18. Flexor brevis pollicis.
19. Flexor sublimis digitorium.
20. Abductor obliquus pollicis.
21. Flexor brevis minimi digiti.
22. Abductor transversus pollicis.

The Superior Cervical Ganglia.—The superior cervical ganglia of the sympathetic lie opposite the second and third cervical vertebræ behind the internal carotid artery. They send branches of communication into the first four pairs of cervical nerves, and also send rami into the roots and ganglia of the trunks of the cranial nerves.

This ganglia connects with the petrious ganglia, the ninth and the twelfth pair of cranial nerves, and through the carotid plexus and cavernous plexus the superior cervical ganglia connect with all the other pairs of cranial nerves.

The deep origin of impulses which reach the superior cervical ganglia come from the upper thoracic nerves via

the sympathetic cords and they are conveyed by way of the white rami communicantes from the upper cervical nerves which join the gangliated cords of the sympathetic and pass upward forming the upward stream.

The functions of the fibers joining the superior cervical ganglia are vasomotor, pilomotor, secretory to the sweat and sebaceous glands affecting the skin of the neck and head.

The nerve impulse of the superior cervical ganglia reaches the eye, ear, and other cephalic organs via the cavernous plexus and the ophthalmic division of the fifth cranial nerves and the carotid plexuses.

The superior cervical ganglia are affected by lesions of the atlas, axis, and third cervical vertebra, and their integrity is also affected by lesions or subluxations of the upper thoracic vertebræ because of interference with the normal nerve impulse of the white rami communicantes coming from the upper dorsal nerves.

The superior cervical ganglia sends branches into the cardiac ganglia situated in the thoracic cavity.

The Middle Cervical Ganglia.—This ganglia is also one of the ganglia of the sympathetic cords situated between the superior and inferior cervical ganglia of the cords of the sympathetic.

These ganglia may be affected by lesions of the fifth and sixth cervical vertebræ as they lie opposite the transverse processes of the vertebræ of this region.

These ganglia supply pilomotor and secretory functions to the sweat and sebaceous glands of the area supplied by the fifth and sixth pairs of cervical nerves.

These ganglia send branches of communication to the fifth and sixth pairs of cervical nerves which they accompany throughout their entire ramification. The middle cervical ganglia also send an important branch to the cardiac plexus of the thoracic cavity. Stimulation

of the middle cervical ganglia has a vasoconstrictor influence upon the lungs.

THE INFERIOR CERVICAL GANGLIA.—This ganglia is the third ganglia in the cervical region of the gangliated cords of the sympathetic system. These ganglia lie between the transverse processes of the seventh cervical vertebra and the first rib and may be disturbed by lesions of the seventh cervical vertebra or first thoracic vertebra.

The inferior cervical ganglia send direct branches of ramification into the cardiac plexus of the thoracic cavity, they supply vasomotor fibers to the subclavian and mammary arteries and send communicating branches to the phrenic nerves. They also send gray rami communicantes to the cardiac plexus. They help to form the thyroid plexus by communicating rami of the stellate ganglia and supply the inferior thyroid ganglia and secretory cells of the inferior maxillary glands.

Gray rami communicantes from these ganglia join the seventh and eighth pairs of cervical nerves and accompany them in their ramification, and also part of the branches of the gray rami joining these nerves pass back to the segments of the cord from which the cervical nerves originate.

THE CERVICAL REGION IN GENERAL.—The lower cervical nerves are not so often interfered with as are those of the middle cervical region, but they are more frequently impinged than are the nerves of the upper thoracic region. We have, however, contractions of the muscles and ligaments of the vertebræ of all the cervical region which cause lesions or impingement of the spinal nerves of those segments. The muscular and ligamentous contractions may be the result of irritation of the sensory nerve causing reflex motor nerve action as a result of external excitation due to exposure.

Some of the results of impingement of the lower cervical nerves are diseases of the arm, hands, such as

felons, writers' cramp, boils, etc. This is due to the fact that the lower cervical nerves enter into the formation of the brachial plexus.

Any interference with the normal nerve supply in this region may involve the integrity of the muscular action and health of the upper extremities. These nerves contribute part of the nerve supply to the muscles of both inspiration and expiration.

Non-action of the Muscles of Respiration.—Choking attacks, coughing attacks, headaches, dizziness, hay fever, asthma, especially bronchial asthma, may be the result of lesions of the lower cervical nerves. Constriction of the lungs and also accelerator influences acting upon the heart are influenced by stimulation of the cervical nerves. The expansion of the chest, pluræ and diaphragm are controlled to a great extent by the middle cervical nerves, while the lower cervical nerves send branches to the muscles of respiration.

The cervical vertebra often are not in exact normal situation as is evidenced by their spinous processes being out of proper alignment. Any deviation from the proper alignment of the cervical spinous processes is positive evidence of a subluxation in this region. Probably the most common ailment in the cervical region is that of musculature contraction. We know that the muscle contraction produces approximation and necks will become stiff and remain so because of the contraction remainder.

The important influence of the cervical nerves upon the organs of the cephallic region is by reason of the connections of the white rami from the upper cervical nerves to the cranial nerves. From the cervical nerves we may influence the functions of organs all the way from the adrenal capsules below to the top of the head above. One of the most important results of contracture

of the muscles or ligaments of the vertebræ of the cervical region is the interference that is caused with the nourishment both of the brain itself and with the segments of the spinal cord of the cervical region.

CHAPTER V.

CERVICAL PLEXUS.

THIS plexus is formed by the ansæ cervicales first, second, and third, the formation of which is between the upper four cervical nerves. By slender communications between these loops and the anterior divisions of the first four cervical nerves the plexus is constituted. It lies behind sterno-mastoid, in front and external to the upper cervical vertebræ, and in front of the upper portion of the scalenus medius and levator anguli scapulæ. It is covered by the deep layer of the cervical fascia. The carotid sheath is an antero-external relation. Motor and sensory nerves come from this plexus. The motor fibers supply the deep muscles of the neck, and the upper portions of scalenus anticus, scalenus medius, levator anguli scapulæ and the diaphragm. By joining the hypoglossal and the spinal accessory nerves they supply indirectly sterno-mastoid, trapezius and the infra-hyoid muscles. The sensory distribution of the cervical plexus comprises the pinna, the region behind it, the parotid region, and the skin of neck as far as the anterior border of trapezius. Downward this area of distribution extends to the skin, covering the clavicular portion of pectoralis major and the anterior half of deltoid.

Besides the filaments innervating the deep muscles of the neck the following nerves come from the cervical plexus:

1. Phrenic nerve.
2. Small occipital.
3. Great auricular nerve.
4. Supra-clavicular nerves.
5. Great superficial cervical nerve.

1. Phrenic Nerve.—This is a mixed nerve, but preponderantly motor. It innervates the diaphragm, containing also sensory fibers for pleura, pericardium, and peritoneum. Its fibers are mainly derived from the anterior division of fourth cervical, but some come from third cervical, and especially fifth cervical nerves. The phrenic nerve runs obliquely downward and forward on the scalenus anticus, and passes behind the sterno-clavicular joint, between subclavian vein and artery. In the thorax, the right phrenic nerve lies external to the superior vena cava, passes along the right side of the pericardium, in front of the root of the lung, together with the arteria comes nervi phrenici, and reaches the diaphragm in front and to the right of the opening for the inferior vena cava. The left phrenic nerve passes along the left side of the pericardium, behind the apex of the heart, and then turns forward to the diaphragm. It enters this structure more anteriorly and further away from the middle line than its fellow, with which it anastomoses.

The course of the left phrenic nerve is thus longer than that of the right.

In their course the phrenic nerves anastomose with the middle and inferior cervical ganglia and the nerves to the subclavius. They send filaments to the pericardium and to the pleuræ. At the diaphragm they ramify partly on its pleural surface, and partly on its peritoneal surface, after having pierced it near the opening for the inferior vena cava. The latter ramifications also supply the inferior vena cava and the suprarenal capsules. On the right side there is a communication of the phrenic nerve with the solar plexus. Thus on the inferior surface of the diaphragm the phrenic plexus is formed, which is in relation with the phrenic ganglion.

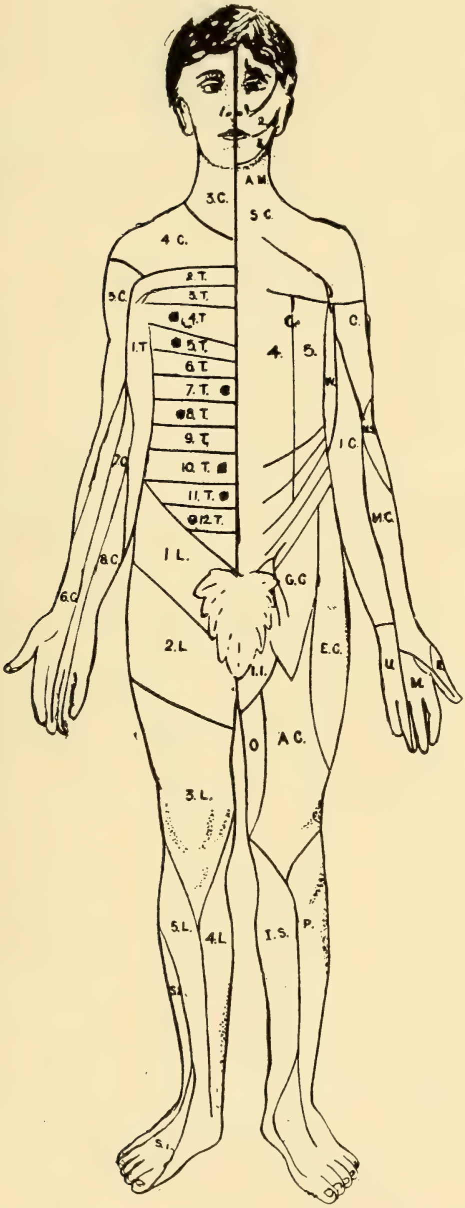
2. Small Occipital, coming from second ansa, emerges about the middle of the posterior border of

sterno-mastoid, follows this border upward and backward, and divides at the mastoid process into an anterior and posterior branch. The latter anastomoses with the great occipital nerve, and ramifies in the skin of the occipital region, externally to the former. The anterior branch anastomoses with the great auricular nerve, and innervates the skin over the mastoid process.

3. GREAT AURICULAR NERVE, purely sensory, like the former, comes from the second ansa just below the small occipital nerve. It also winds round the posterior border of sterno-mastoid slightly below the former nerve, passes on to the anterior surface of that muscle, and runs upward and slightly forward. At the lobule of the ear it divides into a large posterior and smaller anterior branch. The latter sends a branch to the parotid gland, which anastomoses with twigs from the facial nerve, and ends in the skin of the temporal region, some fibers reaching the outer surface of the pinna. The posterior branch ramifies the skin covering the inner surface of the pinna.

4. SUPRA-CLAVICULAR NERVES are chiefly or completely sensory. They come from the anterior division of the fourth cervical nerve and ansa third, emerge at the posterior border of sterno-mastoid, and go partly forward (anterior branches) to the internal and superior pectoral regions, partly over the middle and outer portions of the clavicle (middle and posterior branches) to the skin covering the first four ribs, the axilla, and the acromion. In many cases a large motor nerve from the anterior division of the fourth cervical nerve runs with the supra-clavicular nerves to the outer portion of trapezius, supplying it.

5. GREAT SUPERFICIAL CERVICAL NERVE, purely sensory, contains the bulk of the anterior division of the third cervical nerve. Winding just below the great auricular nerve around the posterior border of the



Showing sensory innervation of the anterior part of the body. (After Eisendrath.)

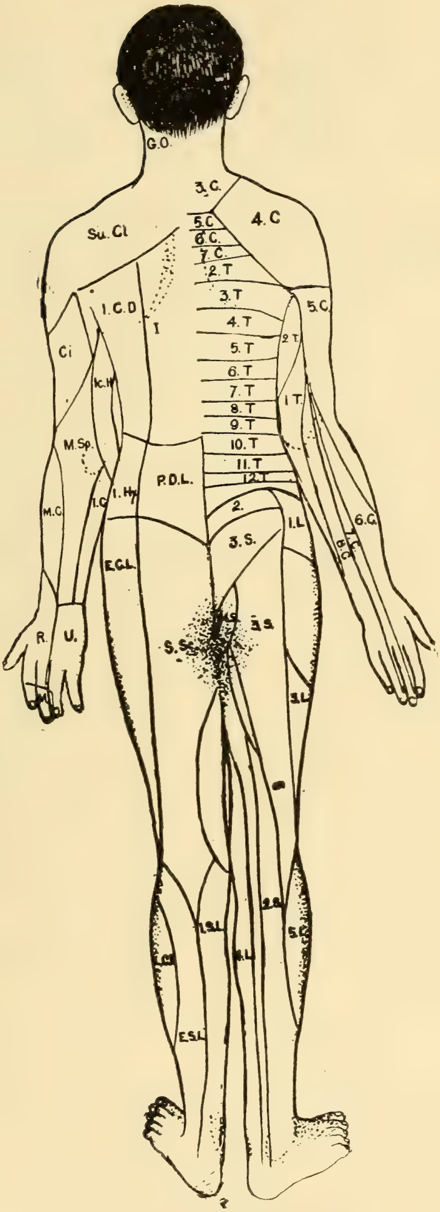
sterno-mastoid, it runs forward, covered by platysma, crosses behind the external jugular vein, and supplies the anterior and inferior portions of the neck. The trunk runs further forward, sends one or more branches upward, which anastomose with the cervical branch of the facial nerve, and ends by ramifying in the skin of the hyoid and mental regions.

BRACHIAL PLEXUS.

As has already been indicated, three primary trunks enter into the formation of the brachial plexus. These trunks are formed by the united anterior divisions of the fifth and sixth cervical nerves, by the anterior division of the seventh cervical nerve, and by the united anterior division of the eighth cervical nerve, and bulk of the anterior division of the first dorsal nerve.

The second primary trunk bifurcates, one branch joining the first, the other the third primary trunk. Thus two secondary trunks are formed; the third secondary trunk is due to the fact that fibers leave each secondary trunk and unite at an acute angle with each other. The uppermost of these secondary trunks joins with a portion of the lowest secondary trunk. Now, three tertiary final trunks are formed apart from the smaller nerves which are given off.

The first tertiary trunk, the most external one in the arm, splits into the median and musculo-cutaneous nerves. This tertiary trunk corresponds to the uppermost secondary and a portion of the lowest secondary trunk. The second tertiary trunk, the most posterior one in the arm, gives off the musculo-spiral and circumflex nerves. It corresponds to the middle secondary trunk. The third tertiary trunk, corresponding to the remaining portion of the lowest secondary trunk, furnishes the ulnar, internal cutaneous, and lesser internal cutaneous nerves.



Showing sensory innervation of the posterior part of the body. (After Eisendrath.)

The brachial plexus supplies with motor fibers the entire upper limb—i. e., the muscles of shoulder, arm, forearm, and hand, and also those of the chest and back which move the arm and shoulder, with exception of the trapezius.

The sensory distribution of the brachial plexus extends over the entire skin covering the upper limb and shoulder, with exception of the anterior surface of the latter, which is innervated by the supra-clavicular nerves.

The brachial plexus passes from the point where its constitutional nerves emerge, obliquely downward and outward between clavicle and first rib, into the axilla. Its primary trunk lies above the subclavian artery on the scalenus medius; they then pass between scalenus medius and anticus into the supra-clavicular fossa, where they are covered by sterno-mastoid, omo-hyoid and the cervical fascia. The plexus then approaches the upper border of the clavicle, near which the transversalis colli artery passes the plexus or goes through its meshes. The plexus then passes between first rib and clavicle, separated from the latter by subclavius muscle. At this point the subclavian (axillary) artery touches it internally; the artery then becomes an anterior relation of the plexus. The latter then passes into the axilla behind pectoralis major and minor, where it lies between serratus magnus and subscapularis. The axillary artery now passes through the meshes of the plexus and becomes a posterior relation.

The nerves coming from the plexus are:

1. Ulnar nerve.
2. Median nerve.
3. Circumflex nerve.
4. Nerve to subclavius.
5. Long thoracic nerve.
6. Musculo-spiral nerve.
7. Supra-scapular nerve.

8. Nerve to the rhomboids.
9. Long subscapular nerve.
10. First subscapular nerve.
11. Third subscapular nerve.
12. Musculo-cutaneous nerve.
13. Internal cutaneous nerve.
14. Lesser internal cutaneous nerve.
15. External anterior thoracic nerve.
16. Internal anterior thoracic nerve.

1. Ulnar Nerve is derived from the inner tertiary trunk of the brachial plexus. Situated at first postero-internally to the axillary artery (brachial artery resp.), separated from the artery by the median nerve, it gradually leaves that vessel, and passes with the inferior profunda artery backwards behind the internal intermuscular septum. It becomes practically subcutaneous behind the internal condyle, but passes again on to the anterior surface. Between flexor carpi ulnaris and flexor profundus digitorum it approaches the ulnar artery, and runs along its inner side to the anterior annular ligament. It passes superficially to this ligament, but deep to the palmar fascia, into the palm of the hand (superficial ulnar nerve). The ulnar nerve has no branches in the arm. Its motor fibers go to the flexor carpi ulnaris, the ulnar portion of flexor profundus digitorum, palmaris brevis, abductor transversus and obliquus pollicis, the hypothenar muscles, the third and fourth lumbricals, and the palmar and dorsal interossei. The sensory distribution comprises those areas of the palm and anterior digital surfaces which are not supplied by the median nerve, also the dorsum of the hand as far as it lies internally to a line extending from the styloid process of the ulna, with an outward convexity to the middle line of the dorsum of the middle finger. The ulnar nerve also supplies the back of the elbow-joint and the ligaments of the hand.

Its branches are:

1. Palmar branch $\left\{ \begin{array}{l} \text{The superficial branch.} \\ \text{The deep branch.} \end{array} \right.$
2. Muscular branches to flexor carpi ulnaris.
3. Dorsal cutaneous branch.
4. Palmar cutaneous branch.
5. Muscular branches to flexor profundus digitorum.

1. Palmar Branch, the terminal branch of the ulnar nerve, passes behind the palmaris brevis, and divides into a superficial and a deep branch.

(a) The superficial branch, the larger of the two, passes in the direction of the main trunk, internally to the hook of the unciform bone, superficially to the flexor brevis minimi digiti. It gives branches to palmaris brevis and the skin, and then splits into the common digital branches fifth and sixth. The former supplies the fourth lumbricals and splits into a branch for the ulnar border of the ring finger and a branch for the radial border of the little finger. The sixth palmar digital branch runs along the ulnar border of the little finger.

(b) The deep branch anastomoses by a filament which winds round the pisiform bone with the dorsal branch, supplies opponeus, flexor brevis, and abductor minimi digiti, and disappears with the deep palmar branch of the ulnar artery between the latter two muscles. In its course it describes a marked curve around the hook of the unciform bone, and goes to supply adductor transversus and obliquus pollicis and the first dorsal interosseous. During the last part of its course it sends fibers to the dorsal and palmar interossei, and to the second and third lumbricals.

2. Muscular Branches to Flexor Carpi Ulnaris.—They are given off where the ulnar nerve passes from the back of the internal condyle to the anterior surface of the forearm.

3. Dorsal Cutaneous Branch begins at the lower

third of the fore-arm, passes between ulna and flexor carpi ulnaris backwards to the dorsal surface, pierces the deep fascia, and appears at the styloid process of ulna. It gives off external branches to the skin of the dorsum of the hand, which anastomose with the radial nerve, and then divides into three branches. The internal one (nervus dorsalis minimi digiti ulnaris) runs along the ulnar border on the dorsal surface of the little finger. The middle branch divides into two branches, one passing along the radial border of the little finger (nervus dorsalis minimi digiti radialis), the other running along the ulnar border of the ring finger. The outer branch also splits into two branches, one for the radial side of the ring finger, and one for the ulnar side of the middle finger.

4. Palmar Cutaneous Branch begins at the junction of upper and middle thirds of the fore-arm, follows the ulnar artery as far as the middle of the fore-arm, and then becomes superficial between the tendons. It now pierces the deep fascia, and runs downwards on it to the skin covering the inner part of the wrist.

5. Muscular Branches to Flexor Profundus Digitorum, which are given off where the ulnar nerve approaches the ulnar artery.

2. Median Nerve.—As described above, the median nerve is formed by the junction of two roots, the larger one being derived from the upper secondary trunk, and the smaller one from the lower secondary. Both secondary trunks lie to either side of the axillary artery; the roots of the median join at an acute angle in front of the vessel, which is thus gripped by a loop. The median nerve thus lies in front of the artery. It follows the brachial artery, being at first antero-external to it, then in front, and finally in the lower third on its antero-internal border. In the antecubital space it passes behind the median basilic vein inwards, behind pronator radii teres and flexor carpi radialis. It then crosses the ulnar

artery just below its origin. From this vessel it receives the arteria comes nervi mediani. The nerve thus gets to the middle line, passes between flexor sublimis digitorum and flexor profundus, and enters the hand by passing under the anterior annular ligament, anteriorly to the tendons of the two muscles mentioned. It now splits into its terminal branches.

The median nerve is a mixed, but preponderantly motor, nerve. It supplies all the muscles on the anterior surface of the fore-arm, except the flexor carpi ulnaris and a portion of flexor profundus digitorum; it also innervates the muscles of the thenar eminence, with the exception of adductor transverses, adductor obliquus, and of the deep head of flexor brevis pollicis. The first two lumbricals also receive their motor fibers from this nerve. The sensory distribution comprises the greater part of the palm of the hand, and the anterior surfaces of the thumb, index and middle fingers, and the radial side of the fourth. On the dorsal surface the area of the median comprises the second and third phalanges of the index and middle fingers, and a portion of the fourth finger. It also sends a branch to the anterior part of the elbow-joint, the interosseous membrane, the periosteum, and the medullary canals of radius and ulna.

In the arm the median nerve only gives off an anastomotic branch to the musculo-cutaneous nerve. It only starts dividing at the antecubital space.

1. Palmar branch.
2. Digital branches.
3. Muscular branches.
4. Anterior interosseous nerve.
    - (a) Branches to flexor longus pollicis and flexor profundus digitorum.
    - (b) Several branches to the interosseous membrane.

1. Palmar Branch is given off at the beginning of the lower third of the forearm. It passes externally to the median nerve between the tendons, and then through the deep fascia to the skin. Below the transverse carpal (anterior annular) ligament it divides into several branches, which end in the thenar eminence and the palm of the hand.

2. Digital Branches.—These are the four terminal branches. The first one, the smallest of the four, arches outwards, supplying flexor brevis pollicis, opponeus, and abductor brevis. It then splits into two branches, which run along the radial and the ulnar border respectively of the thumb, the outer one giving off the branch to the first lumbrical. The second digital branch supplies the cleft between thumb and index, and ends along the radial border of the index. The third digital branch gives off a branch to the second lumbrical, and splits into a branch for the ulnar side of the index and a branch for the radial side of the third finger. The fourth digital branch communicates by an anastomotic branch with the ulnar nerve, and divides into a branch for the ulnar side of the third and one for the radial side of the fourth finger.

3. Muscular Branches.—Within the space mentioned three are given off: To pronator radii teres, to palmaris longus and flexor carpi radialis, and to flexor sublimis digitorum. This last muscle receives two more fibers in the forearm.

4. Anterior Interosseous Nerve arises from the median at the level of the origin of the anterior interosseous artery, and runs downwards along the outer side of this vessel to the pronator quadratus. Its branches are:

(a) Branches to flexor longus pollicis and flexor profundus digitorum.

(b) Several branches to the interosseous membrane,

which send filaments into the nutrient foramina of radius and ulna, and to the periostia of these bones.

3. Circumflex Nerve, one of the terminal branches of the middle secondary trunk. It winds with the posterior circumflex artery around the surgical neck of the humerus, passing between teres major, minor, long head of triceps, and humerus. It ends in the deltoid.

In its course it gives off the following branches:

(a) Articular branches.
(b) A cutaneous branch.
(c) A branch to teres minor.

(a) Articular branches to the anterior and posterior surfaces of the shoulder-joint.

(b) A cutaneous branch, which either pierces the posterior fibers of the deltoid or passes between it and the long head of triceps. It ramifies in the skin covering the posterior surface of these muscles.

(c) A branch to teres minor.

4. Nerve to Subclavius.—Coming from the fifth and sixth cervical nerves, it passes in front of the plexus to the scalene tubercle on the first rib, where it divides into two branches, one going to the subclavius muscle, the other joining the phrenic nerve.

5. Musculo-spiral Nerve.—This is the largest of all the nerves derived from the brachial plexus. It comes from the middle secondary trunk, and represents, with the circumflex nerve, the posterior tertiary trunk. In the axilla the musculo-spiral nerve passes behind the axillary artery, internally to the circumflex nerve. It then crosses the tendons of teres major and latissimus dorsi, and thus gets on to the outer head of triceps. Between this head and the inner head it passes backwards and outwards with the superior profunda artery to the musculo-spiral groove. It enters this groove, and passes in it around the posterior circumference of the shaft of the humerus. After this spiral-shaped course it

runs between brachialis anticus, and brachio-radialis (supinator longus) on the anterior surface of the limb, where it appears internally to the outer condyle. Here it divides into a superficial branch, the radial nerve, and a deep one, the posterior interosseous nerve.

The musculo-spiral nerve is, like the median and ulnar nerves, a mixed nerve. Contrary to the former, it gives off numerous branches in the arm, which are both motor and sensory. The motor distribution of this nerve comprises the three heads of triceps, brachialis anticus, anconeus, all the muscles on the extensor surface of the forearm, including brachio radialis—i. e., supinator brevis, extensor carpi radialis brevior and longior, extensor carpi ulnaris, extensor communis digitorum, extensor minimi digit, extensor indicis, extensor primi internodii, extensor secundi internodii, and extensor ossis metacarpi pollicis. Its sensory area extends over the skin covering the dorsal surfaces of forearm and hand and a small portion of the arm. This latter area corresponds to the skin covering the brachialis anticus; it is limited above by the posterior border of the deltoid, internally by the outer head of triceps, and anteriorly by the outer border of biceps.

In the forearm, the inner boundary of its cutaneous distribution corresponds to a line extending along the extensor carpi ulnaris to the ulnar styloid process, and then bending with a marked inward convexity to the middle line of the dorsal surface of the middle finger. The outer boundary corresponds to the outer border of extensor carpi radialis longior, and then passes across the styloid process of the radius to the thenar eminence, and over the palmar surface of the latter to the metacarpo-phalangeal joint of the thumb. The terminal phalanges of thumb, index, and middle fingers are, as already mentioned, innervated by the median nerve.

The branches of the musculo-spiral nerve are:

1. Radial nerve.

2. Muscular branches to the triceps.
3. Lower cutaneous branch.
4. Posterior interosseous nerve.
5. Upper cutaneous branch of musculo-spiral nerve.

1. Radial Nerve and the smaller, sensory, terminal branch. It follows at first the outer side of the radial artery, leaves it at the middle third of the forearm, passes backwards and outwards behind the tendon of brachio-radialis, and pierces the deep fascia of the extensor surface of the forearm. It crosses inwards over the styloid process of the radius, and divides into four or five terminal branches. The first branch furnishes the nervus dorsalis pollicis radialis. The second branch furnishes the nervus dorsalis pollicis ulnaris; the third, the nervus dorsalis indicis radialis; and the fourth, the nervus dorsalis indicis ulnaris and the nervus dorsalis digito medii radialis. The fifth branch communicates with the most external branch of the dorsal branch of the ulnar nerve, thus forming the nervus dorsalis medii digiti ulnaris.

2. Muscular Branches to the triceps, one branch to each head. They are given off below the tendon of latissimus dorsi. The first branch accompanies for a certain distance the ulnar nerve, supplies the elbow-joint, and ends in the middle head.

3. Lower Cutaneous Branch.—This is a pretty large branch which arises within the musculo-spiral groove. It passes between middle head of triceps and brachio-radialis, pierces the deep fascia and becomes subcutaneous between olecranon and external condyle. It supplies the skin over the extensor surface of the forearm.

Muscular Branches to brachialis anticus, brachio-radialis, and extensor carpi radialis longior. They are given off where the musculo-spiral nerve leaves its groove and passes on to the anterior surface of the limb.

4. Posterior Interosseous Nerve, the larger, chiefly motor, terminal branch of the musculo-spiral nerve. It passes backward and downward through the supinator brevis, and then downward under the extensor communis digitorum. At the junction of the middle and lower third of the forearm it passes between extensor primi and extensor secundi internodii on to the posterior surface of the interosseous membrane, and runs downward on it, supplying it with sensation. It terminates in the carpal joints, a few fibers anastomosing with the dorsal branch of the ulnar nerve. In its course it supplies the following muscles:

1. Extensor carpi radialis brevior.
2. Supinator brevis.
3. Extensor carpi ulnaris.
4. Extensor communis digitorum.
5. Extensor ossis metacarpi pollicis.
6. Extensor primi and secundi internodii.
7. Extensor indicis.

6. Long Thoracic Nerve (Bell's nerve) comes from fifth, sixth and seventh cervical nerves, passes downward and outward between scalenus medius and the meshes of the brachial plexus, and gives branches to each serration of serratus magnus. Some describe the two nerves mentioned as "posterior thoracic nerves."

7. Supra-scapular Nerve.—This is a large nerve derived from the first primary trunk of the brachial plexus. It runs along the lower belly of omo-hyoid to the supraspinous fossa of the scapula, and passes below the transverse ligament of the scapula to the infraspinous fossa. It supplies supraspinatus, the posterior surface of the shoulder-joint capsule, and infraspinatus.

8. Nerve to the Rhomboids, comes from anterior division of the fifth cervical nerve (in some cases from anterior division of fourth cervical), passes through scalenus medius downwards to the rhomboids and the

upper serration of serratus posticus superior. It also sends filaments to levator anguli scapulæ.

9. Long Subscapular Nerve arises near the former, and passes between serratus magnus and subscapularis downwards to latissimus dorsi.

10. First Subscapular Nerve leaves the middle secondary trunk of the plexus, and terminates in the subscapularis.

11. Third Subscapular Nerve arises from the same trunk at a lower level, and supplies teres major and the lower portion of subscapularis.

12. Musculo-cutaneous Nerve comes from the upper secondary trunk of the brachial plexus, just above the formation of the outer tertiary trunk. Situated at first antero-externally to the median nerve, it passes to the inner surface of coraco-brachialis, piercing that muscle. Its further course is between coraco-brachialis and biceps (nervus cutaneous anti-brachii lateralis); this is the cutaneous branch of the musculo-cutaneous. At the outer border of the tendon of biceps it pierces the deep fascia, and ramifies in the skin which covers the brachio-radialis (supinator longus). Its distribution extends as far as the inner portion of the thenar eminence. The musculo-cutaneous is a mixed nerve, supplying, apart from the cutaneous distribution, the large vessels of the arm, coraco-brachialis, brachialis anticus, and biceps.

13. Internal Cutaneous Nerve has the same origin as the former. Situated at first behind and internally to the axillary vein, it passes forward and inward to it, and runs in front of the basilic vein. It pierces together with this vein the deep fascia of the arm, and then divides into two branches, a volar and an ulnar branch. It is a purely sensory nerve, which supplies the skin of the arm, covering biceps muscle.

(a) Volar branch.
(b) Ulnar branch.

(a) Volar Branch descends in front, and with the basilic vein, passes in the antecubital space behind the median-basilic vein, and ramifies in the skin covering the inner portion of the volar surface of the forearm as far as the external border of the flexor carpi radialis.

(b) Ulnar Branch goes to the internal condyle, and supplies the skin over it and the flexor carpi ulnaris as far as the carpus.

14. Lesser Internal Cutaneous Nerve.—Arising from the lower secondary trunk, it passes through the axilla, behind, then internally to the axillary vein. Having pierced the deep fascia of the arm, it supplies the skin of the inner side of the arm and the inner condyle. In the axilla it receives a branch from the anterior division of the second dorsal nerve. It is a purely sensory nerve, which supplies the inner cutaneous surface of the arm, from axilla to inner condyle. Its area of distribution is limited anteriorly by the inner border of biceps; posteriorly it extends on to the outer head of triceps practically as far as the middle line.

15. External Anterior Thoracic Nerve comes from the uppermost secondary trunk, and passes in front of axillary artery and behind clavicle to pectoralis major.

16. Internal Anterior Thoracic Nerve arises from the end of the lower primary trunk, emerges behind the axillary artery, anastomoses with the former nerve, and supplies with the bulk of its fibers, the pectoralis minor. The other fibers go to pectoralis major.

CHAPTER VI.

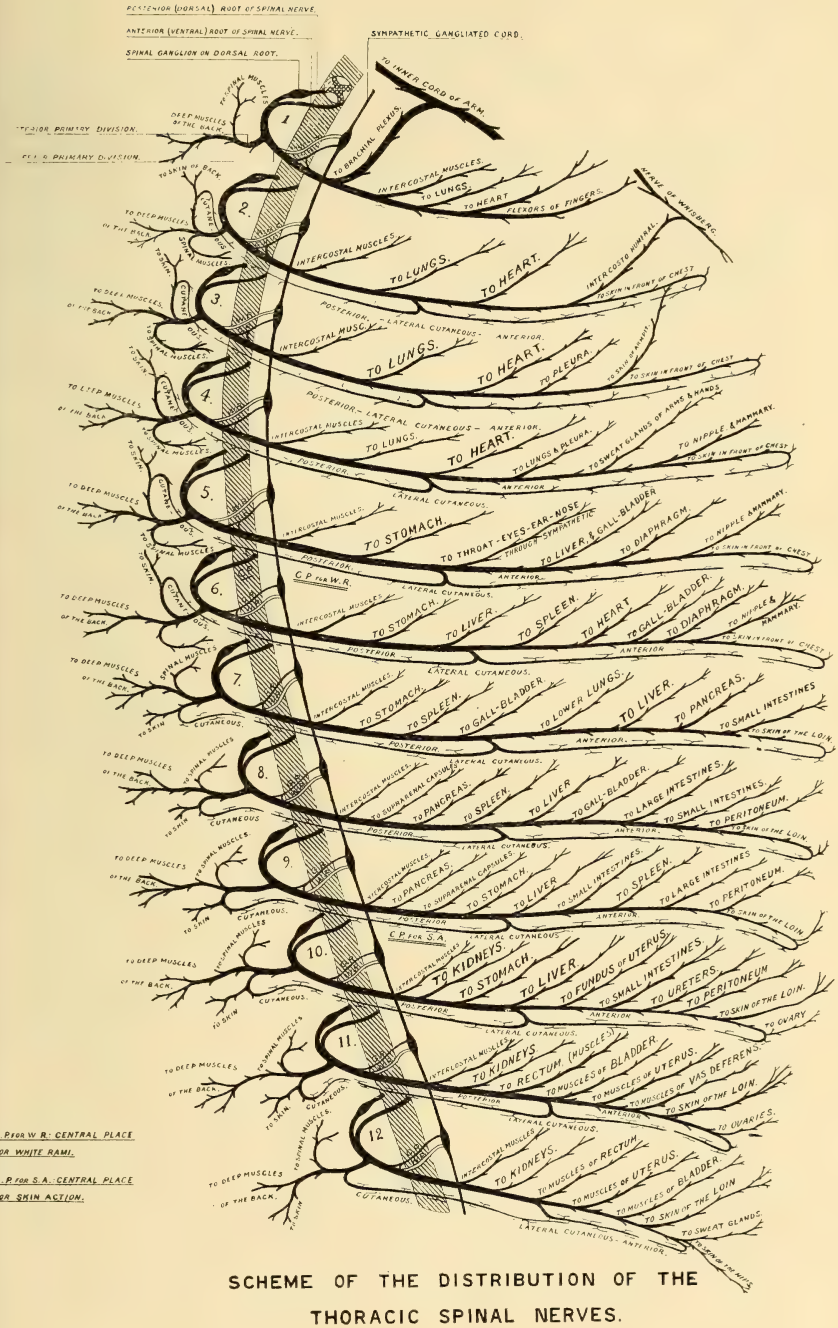
THORACIC NERVES.

THE ramification of the thoracic nerves is more difficult to trace and understand because of the fact that the anterior branches, or those branches supplying the internal viscera, are distributed largely through the ganglia of the sympathetic system to the viscera they supply. The anterior branches of the spinal nerves join the gangliated cords and the great plexuses of the sympathetic; the spinal branches that join the two gangliated cords are not always distributed to the viscera immediately approximating the point where they join, nor to the viscera of that level. Many of the spinal fibers joining the ganglia of the cords pass upward or downward to be distributed to the viscera, organs, or parts above or below where they join the sympathetic ganglia.

2. First Pair of Thoracic Nerves.—This pair of nerves pass out or extend from the neural canal between the pedicles of the first and second thoracic vertebræ. They are affected by any abnormality of the articulation between the first and second thoracic vertebræ. This pair of nerves may be relieved by adjusting the second thoracic vertebra back or inferior, or by adjusting the first thoracic vertebra forward or superior, by the application of a thrust to its spinous process.

They contribute branches to the following nerves: median, ulnar, internal anterior thoracic, internal cutaneous, lesser internal cutaneous, long subscapular, and usually to the musculo-spiral.

They supply the following muscles: pectoral muscles, erector spinæ, serratus posticus, scaleni, latissimus dorsi, flexors of the fingers, levator costæ, intercostal and deep muscles of the back and the spinal erector muscles.



SCHEME OF THE DISTRIBUTION OF THE THORACIC SPINAL NERVES.

This pair of nerves also ramify the upper part of the lungs and of the heart, and are connected with the stellate ganglia by gray rami communicantes from the sympathetic system, and usually send white rami communicantes to the stellate ganglia of the sympathetic; they in this way reach the vessels of the side of the head and affect dilatation of the pupils of the eyes and widening of the palpebral opening.

3. The Stellate Ganglia.—The stellate or first thoracic ganglia of the sympathetic lie against the head of the first rib. They may be affected by pressure, and also by abnormal afferent impulses from interference with the first thoracic pair of nerves.

They are important and contain cells of generation of accelerator impulses to the heart muscles, vasomotor fibers to the lungs, vasomotor fibers to the thyroid gland and inferior thyroid arteries, and vasoconstrictor fibers adjoining the phrenic nerves. Vasomotor, pilomotor, and secretory and sebaceous fibers accompany the spinal nerves to the arms and hands; vasofibers also join the vertebral plexuses.

Important spinal nerve fibers pass through these ganglia from the upper thoracic nerves on their way to the superior cervical ganglia, and through this channel the spinal fibers of the upper thoracic nerves reach and affect the head, face, and neck.

The first thoracic or stellate ganglia, in connection with the other nerves composing the brachial plexuses, supply the upper extremities, and it is interference with this pair of nerves joining a stellate ganglion that is responsible for the claw hand, due to contracture of the muscles, and cause also the stunted growth of the finger-nails, and the waxy, clubby, distorted, and gouty finger-joints. It is an excitation of the trophic functions of these nerves that causes hypertrophy or overgrowth. Neuralgia and paralysis of the arm and lesions of the

joints at the elbow and wrist are all caused by nerve lesions of this region.

4. The Second Thoracic Nerves.—They pass out or extend from between the pedicles of the second and third thoracic vertebræ, and are affected by lesions of the articulation between these vertebræ. Adjust the second spinous process superior or the third spinous process back or inferior for relief of interference with this pair of nerves.

The second thoracic nerves ramify the intercostal muscles between the second and third ribs, the multifidus and erector spinæ, and serratus posticus superior, etc. Lesions of this pair of nerves alter motor effects of voluntary muscular action of the muscles supplied by it.

They also alter the sensory effects and vasomotor effects on the heart and bronchi, vasomotor effects on lungs, vasoconstrictor effects on vessels of the eye, head, face, and neck, and motor effects on the pupil of the eye through the rami communicantes that they send to the superior cervical ganglia of the sympathetic system.

These nerves connect with the second thoracic ganglia of the sympathetic by both gray and white rami communicantes and with the first and third pair of thoracic nerves.

5. Third Thoracic Nerves.—They pass from the neural canal between the pedicles of the third and fourth thoracic vertebræ and are interfered with by lesions of the articulation between these two vertebræ as they extend from the neural canal.

These nerves may be relieved by throwing the spinous process of the third thoracic vertebra anterior or forward, or by applying a thrust to the spinous process of the fourth thoracic vertebra, throwing it inferior or backward. The patient in the adjustment of thoracic vertebræ usually lies upon a specially prepared table in a prone position.

These nerves supply the intercostal muscles in the interspace between the third and fourth ribs, and also supply the muscles of the spine in the immediate region of the spinous process of the third thoracic vertebra.

These nerves have vasomotor effects on blood vessels of the head, face, neck, lungs, arms, chest, and affect the pupillo-dilator muscles, and supply vaso-motor fibers to the heart.

They affect the secretions of the submaxillary and sweat glands of arms, neck, and chest; interference with them disturbs sensation in the third intercostal space and over the third spinous process, also a portion of the mammary glands and the third ribs. Pleurisy and disease of the upper lungs are relieved by removing all interference with this pair of nerves.

They are connected with the third pair of ganglia of the sympathetic cords by both gray and white rami communicantes, and with the second and fourth pairs of thoracic nerves.

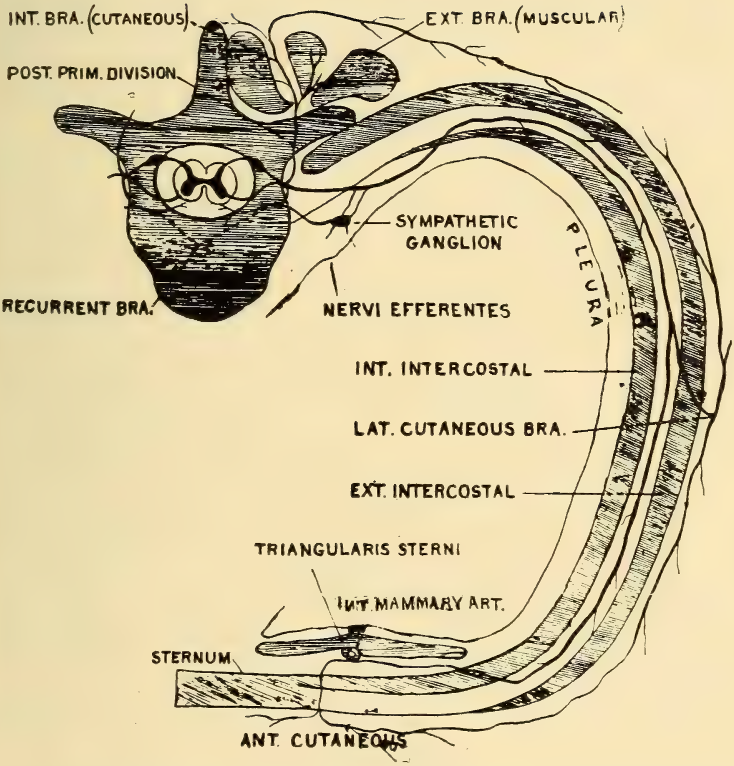
All thoracic nerves furnish accelerator nerve impulses to the heart from the first downward to the fifth thoracic pair of nerves; pupillo-dilator fibers come from the same region.

In the upper thoracic region of the spinal column are nerves to the nutrient, sweat, and emotional centers.

6. Fourth Thoracic Nerves.—This pair make their exit through the foramina between the pedicles of the fourth and fifth thoracic vertebræ, and may be affected by lesions of their articulation with each other. They supply the intercostal and levator costæ muscles and the deep muscles of the back.

They connect with the fourth pair of thoracic ganglia of the sympathetic cords by gray and white rami communicantes, and connect with the third and fifth thoracic pairs of nerves.

This pair send nerve filaments to the heart ventricles



Plan of origin and distribution of a thoracic nerve, showing the manner of supply to the intercostal space, to the skin, and to musculature of the spinal column.

and to the lungs; they supply the sweat glands of the arms and hands and the region of the nipple and mammary glands; they affect the salivary glands and tonsils slightly, and supply the periosteum of the fourth ribs and the pleuræ.

We relieve contractions that interfere with these nerves and with the nutrition of the fourth segment of the spinal cord by the application of a thrust to the spinous process of either the fourth or fifth thoracic vertebra, throwing the fourth superior or the fifth inferior.

7. Fifth Thoracic Nerves.—From the neural canal their exit is between the pedicles of the fifth and sixth thoracic vertebræ. They supply the muscles, especially of the fifth intercostal spaces, and approximate muscles of the spinal column.

They connect with the fourth and sixth thoracic nerves and the fifth thoracic pair of ganglia of the sympathetic system; through this union we get vasoconstrictor and secretory fibers to the arms, lungs, and pulmonary vessels, and the sweat glands and accelerator fibers to the heart.

The white rami communicantes from these nerves join the fifth thoracic ganglion of the sympathetic and pass upward and affect the sebaceous glands of the face and the lachrymal glands; they furnish ramifying fibers which reach the gall-bladder, stomach and liver.

They send fibers to the aortic plexus, cardiac plexus, pulmonary plexus, esophageal plexus, vasomotor nerves to the abdominal visceræ, and sensory and secretory and visceroinhibitory to the stomach.

They also send filaments to the mammary glands, to the area of the nipple, the gall-bladder, liver, and spleen.

They help form the great splanchnics through their union with the fifth sympathetic ganglia.

They may be relieved by adjusting the sixth thoracic

spinous process back or inferior, or by adjusting the fifth thoracic spinous process to the front or superior.

The distribution of these nerves to the organs of the head is through a continuation of the white rami up the gangliated cord of the sympathetic, unchanged until they terminate in the cells of the superior ganglia of the sympathetic of the cervical region, in which they are changed and distributed.

This is true of all the white rami communicantes from the spinal nerves, from the first or second thoracic down to the sixth pair. The fifth pair, or more often the sixth pair, of thoracic nerves is the dividing-point, since the upper five pair of rami communicantes from the spinal nerves are distributed upward, and below this point the white rami pass downward, with the exception of some fibers from the liver and kidney nerves, which affect the organs of the head and the skin of the upper extremities indirectly.

8. The Sixth Thoracic Nerves.—This pair of nerves extend from the neural canal, passing through the foramina between the pedicles of the sixth and seventh thoracic vertebræ.

This pair of nerves is of especial importance, because it is here we generally find the dividing-line between the two streams of the white rami communicantes as they are distributed to and through the ganglia of the sympathetic cords.

It is an anatomical fact that the white rami communicantes from the upper five thoracic pair of nerves join the gangliated cords of the sympathetic and are distributed partly directly through the ganglia where they join the sympathetic system, while the remaining fibers pass up the gangliated cord to be distributed to the regions above.

Some of the fibers reach the superior cervical ganglia

of the sympathetic system and are distributed through it to the twelve pairs of cranial nerves.

The white rami communicantes from the sixth pair of spinal nerves and the spinal nerves below this point are distributed to the gangliated cord, where part of the fibers supply viscera directly through the ganglia where they join, while the other fibers pass downward in those cords and are distributed to the organs in relation below.

It is for this reason that this pair of nerves, or, rather, this segment of the cord, is recognized as the central point of the spinal nervous system and the dividing-line between the two streams of distribution of the white rami from the spinal nerves.

Any interference with this pair of nerves is decidedly more far-reaching in effects than is the interference with any other pair of the spinal nerves.

These nerves send branches to the great cardiac plexus and the aortic and pulmonary plexuses of the thoracic cavity.

This pair of nerves supply sensation to the integument over the sixth interspace between the ribs, and they send branches to the splanchnics, the aortic, and the solar plexuses of the abdominal cavity. These nerves connect directly with the sixth pair of thoracic ganglia of the sympathetic and also send communicating branches to the fifth and seventh thoracic pairs of nerves.

The relief of these nerves produces a decided effect upon the sweat glands of the entire body, especially of the upper portion, in the region of the chest and arms.

This pair of nerves supply viscero-inhibitor branches to the stomach and intestines, vasomotor branches to the abdominal blood vessels, and vasoconstrictor fibers to the portal veins; they also send filaments to the gall-bladder and bile-ducts.

This pair of nerves exercise a decided control over the

liver and supply nerve filaments to the mammary glands and also supply the diaphragm.

There is no pair of nerves whose ramifications affect so many of the viscera of the trunk or have so general an effect upon the surface of the body as this pair of nerves.

9. THE SEVENTH THORACIC NERVES.—This pair of nerves make their exit one on either side from the neural canal through the foramina between the pedicles of the seventh and eighth thoracic vertebræ.

These nerves join, by branching, with the sixth and eighth pairs of thoracic nerves, and also with the seventh thoracic ganglia of the gangliated cords of the sympathetic.

They supply the muscles of the back around the seventh thoracic process, also the intercostal muscles of the seventh interspace between the ribs. The seventh nerve from the right side of the spinal column is distributed principally to the liver.

This pair of nerves also send vasomotor fibers, and trophic fibers are also supplied to the spleen, pancreas, lower part of the lungs, stomach, small intestines, and renal vessels, and also vasoconstrictor fibers to the vessels of the stomach and to the portal veins.

They also supply sensory and secretory fibers to the stomach, liver, and the gall-bladder, and vasomotor filaments to the central portion of the liver.

10. EIGHTH PAIR OF THORACIC NERVES.—These nerves extend from the neural canal through the intervertebral foramina between the pedicles of the eighth and ninth thoracic vertebræ.

They send white rami communicantes to and receive gray rami communicantes from the eighth pair of ganglia of the gangliated cords of the sympathetic; they also give off branches which join the seventh and ninth pairs of thoracic nerves upon both sides of the spinal column.

These nerves supply the muscles of the abdomen and of the spine in the region of the eighth spinal process, and

also the intercostal muscles in the eighth intercostal space.

These nerves send filaments especially to the kidneys, pancreas, and spleen, small intestines, and supply vaso-constrictor filaments to the portal veins, gall-bladder, supra-renal capsules, and the upper part of the large intestines and the transverse colon; they also supply filaments to the small intestines and to the peritoneum.

The nerve upon the right side of the eighth spinal segment sends filaments into the liver, and is responsible to a considerable extent for the function of this organ.

11. THE NINTH AND TENTH PAIRS OF THORACIC NERVES.—These two pairs of nerves are given off from the ninth and tenth segments of the spinal cord and extend through the intervertebral foramina below the pedicles of the ninth and tenth thoracic vertebræ, respectively.

These nerves supply the muscles of the spinal column of their own regions and supply the rectus abdominis muscles, both external and internal, the transversalis, and the erector and multifidus spinæ; they also supply the integument, both above and below the umbilicus.

These pairs of nerves each give off branches to the pairs of nerves above and below each of them and to each other, and also send white rami to the ninth and tenth thoracic ganglia of the sympathetic cords, and receive gray rami from the same ganglia.

These nerves furnish part of the nerve supply to the aorta, kidneys, ureters, and adrenals, and also fibers to the pancreas, spleen, liver, and stomach.

We also find fibers from these nerves distributed to the testes or, in the case of females, to the ovaries and the fundus of the uterus, also to some of the convolutions of the small intestines and peritoneum, and to part of the large intestines.

Effects of impingement of these pairs of nerves, especially the tenth, affect the diaphragm and lower

part of the lungs, also the eyelids and the tissues around the eyeballs and the muscles of the equilibrium of the eyes; and all nerves above the tenth pair affect the secretory action of the skin above to the upper extremities and the head and upper part of the trunk, while the nerves below this pair control the secretions of the skin to all parts below the tenth pair of nerves—the "central place" for skin-action. The pairs of nerves of the thoracic region above the tenth pair all produce pilomotor effects on the integument of the upper part of the trunk, of the upper extremities, and of the head, while the tenth pair and all pairs below produce pilomotor effects upon the lower extremities; hence this pair of nerves are "central place" for skin action.

12. Eleventh and Twelfth Pairs of Thoracic Nerves.—These nerves, coming from the eleventh and twelfth segments of the spinal cord, pass from the spine below the eleventh and twelfth thoracic vertebræ, as described of the ninth and tenth pairs of nerves above.

They join their corresponding thoracic ganglia of the sympathetic system and the thoracic spinal nerves both above and below them, and also join each other by communicating branches.

They especially ramify and supply vasomotor, trophic, and secretory fibers to the kidneys, aorta, pelvic viscera, and lower abdominal viscera.

These nerves also supply fibers to the muscles of the rectum, bladder, vas deferens, and uterus, the sweat and sebaceous glands of the lower part of the body, and to the lower extremities.

These nerves contribute fibers to the lesser splanchnic plexuses, which are formed principally from the twelfth pair of thoracic nerves and their corresponding ganglia of the sympathetic cords.

A relief of these nerves, especially of the twelfth pair in connection with the sixth pair of thoracic nerves, is almost a specific for typhoid fever.

CHAPTER VII.

LUMBAR NERVES.

THE vertebræ of the lumbar region are the largest of the movable vertebræ. Their bodies are kidney-shaped, the transverse diameters being greater than the antero-posterior.

The notches in the pedicles are deeper than those in the pedicles of the thoracic vertebræ, and this makes the intervertebral foramina larger than those of the thoracic region.

The spinous processes are short, large, and rectangular, and point outward in nearly a horizontal direction.

Their transverse processes are usually longer and more slender; consequently they are not as strong as those of the thoracic vertebræ.

The intervertebral discs are quite thick between the vertebræ of the lumbar region; they are slightly thicker in front than posteriorly; as also the bodies of the vertebræ are deepest in front; especially is this true of the fifth lumbar vertebra, which is quite wedge-shaped.

The discs in the lumbar region are particularly liable to compression on account of the strains and the superimposed weight of the body, the trunk resting wholly upon them.

Any curvature of the spinal column depends more on the thickness and elasticity of the intervertebral discs than on the size or shape of the bodies of the vertebræ.

The thickness of the intervertebral discs depends upon the contractured condition of the ligaments which bind and approximate the lumbar vertebræ together.

The ligaments of this region are thick and strong, much more so than are those of the thoracic or cervical regions of the spine.

They are also more subject to irritation and injury, which will cause them to shorten and thicken, and this shortening of these ligaments will approximate the vertebræ and thus cause a narrowing of the intervertebral foramina, which will interfere with the transmission of veins, arteries, lymphatics, and nerves.

The lumbar nerves are the largest nerves given off from the spinal cord, and the anterior branches increase in size from above downward, or from the first to the fifth pair.

Each pair of lumbar nerves sends branches to the pair of nerves immediately above and below them, and they communicate with the sympathetic gangliated cords, by sending to them white rami communicantes and also by receiving gray rami communicantes from the sympathetic, which branches join the lumbar nerves and are distributed with them.

Branches from the twelfth thoracic nerves and from the first three pairs of lumbar nerves, together with a large portion of the fourth lumbar, form the lumbar plexuses.

Part of the fourth lumbar pair of nerves, together with the fifth pair, join the sacral nerves and help in the formation of the sacral plexus.

The lumbar nerves are very important, for the reason that the largest and longest nerve trunks in the body are made up of the lumbar and sacral nerves.

These nerves supply the pelvic cavity largely and also the whole of the lower extremities. Nerve fibers extend from the lumbar region to the ends of the toes.

Contraction of ligaments and muscles and the consequent approximation of the lumbar vertebræ, causing interference with the nerve supply to the lower extremities, is largely responsible for rheumatic conditions—lumbago, sciatica, and practically all ailments of the lower extremities, and of interference with the power of

locomotion, except where these troubles come from the nerve-centers in the brain which control the action of the lower limbs. The sacral nerves are of less importance to us from the fact that they extend from the neural canal through solid bony foramina that cannot be affected by contraction of ligaments.

THE FIRST PAIR OF LUMBAR NERVES.

THESE nerves extend or pass out from the neural canal between the pedicles of the first and second lumbar vertebræ; they supply part of the muscles of the lower abdomen and of the lower thoracic region and also furnish filaments to the first lumbar vertebra and its ligaments.

These nerves give off branches and help to form the ilio-inguinal, ilio-hypogastric, and also help in the formation of the genito-crural, besides sending branches to the nerves below and above and to the first lumbar ganglia of the sympathetic.

These nerves supply sensation to a part of the peritoneum, to the integument over the trochanter and just below, and to the upper and inner aspects of the thighs, and also to the scrotum, and to part of the external genitalia and to the gluteal regions.

They also furnish vasomotor, trophic, secretory, and sensory fibers, carrying impulses to the lower colon, uterus, bladder, ureters, epididymis, Fallopian tubes, vas deferens, to the muscular walls of the rectum, to the vessels of the abdomen, to the lower limbs, and to the sweat and sebaceous glands of the integument of this region and the lower extremities.

The first pair of lumbar nerves usually have more control over the bladder than any other pair of nerves and seem to exercise the principal controlling influence over the health and action of this organ, and especially

supply tone to the sphincter muscles of the bladder in connection with the second pair of lumbar nerves.

If a lesion affecting these nerves tends to impair their activity or excitability, there will be, as a result, impaired transmission of impulse, causing a relaxed or paralytic condition of the bladder and of the sphincter muscles thereof; while on the other hand, if the lesion is irritative, the patient will experience a condition called "vesical tenesmus," and may be unable to relax the sphincter muscles so as to easily perform the act of micturition.

THE SECOND PAIR OF LUMBAR NERVES.

THE second lumbar vertebra is a typical one. Its most common variation from its normal position or relation is that of undue approximation, which is caused by a contraction of the ligamentous and muscular bands that bind it to its adjacent vertebræ.

Any undue approximation of this vertebra to the one immediately below it will cause a narrowing of one or both of the second lumbar intervertebral foramina and a consequent interference with one or both of the second pair of lumbar nerves. This will also interfere with the blood vessels and lymphatics as well as the nerves which they accompany.

Lesions of the second lumbar nerves will also affect the ligaments and muscles that cause the undue approximation, sometimes causing contraction remainder that will continue the undue approximation. It is also well to remember that any lesion of the nerve that will excite or irritate these nerves will cause undue contraction and also hyperesthesia and pain.

If a paralytic condition is induced by impingement, causing an impairment of the transmission of the vital force, there will be a relaxed condition that will affect

all of the organs supplied by these nerves, causing them to be in an atonic condition.

The second pair of lumbar nerves either chiefly or partly form the genito-crural, antero-crural, external cutaneous, recurrent meningeal and obturator nerves, and they also send branches to the aortic and hypogastric plexuses.

The genito-crural nerves, soon after passing from the intervertebral foramina, pass into and through the psoas muscles and fascia upon either side, and they then divide into the genital and crural nerves.

The genital branches supply the inguinal canals. They each enter through the internal abdominal ring and accompany the spermatic cords on their way through the inguinal canals.

Filaments from these nerves supply the iliac arteries, the cremasteric muscles, and the integument of the scrotum and of the thigh in that immediate region. In females these nerves supply the round ligaments.

In case of an interference, causing a paralytic condition of these nerves, the skin of the scrotum will not respond to any irritation, and there is a relaxed and dependent condition of the testicles.

The inguinal canals, one or both, will be in a relaxed condition, owing to the lack of tonicity of the muscular walls, which condition permits protrusion of a segment of the intestines, or hernia.

The cremasteric reflex will be lessened or will be entirely absent, owing to the amount of interference with the nerve supply.

Through the lumbar and pelvic plexuses the second pair of lumbar nerves send vasomotor, trophic, secretory, and sensory impulses to the lower colon, uterus, bladder, ureters, epididymis, Fallopian tubes, external genitalia, vas deferens, to the muscular walls of the rectum, to the vessels of the abdomen and the lower limbs, and to the

sweat and sebaceous glands of the integument of the lower extremities.

This segment of the spinal cord, from whence come this pair of nerves, is said to contain the centers for defecation, parturition, and micturition.

Both defecation and micturition are reflex phenomena, hence there must be a stimulus and normal reflex excitability of the nerve fibers without any interference with the normal action or excitability thereof.

In case of micturition, the stimulus is the accumulation of urine in the bladder, until it reaches a certain amount, causing pressure to a certain degree. This condition will act as a stimulus, which, through excitation of the nerve action, will cause contraction of the bladder walls and at the same time a relaxation of the vesical sphincters.

In the lower bowel and in the rectum the fecal matter acts as a stimulus, causing reflexly, but involuntarily, peristaltic movements of the lower bowels.

Parturition, to be normal, must be governed by a normal supply of nerve impulse. A depreciation of the excitability of the nerve supply is responsible for "inertia uteri" in proportion to the lessened excitability of the nerve supply. The process of parturition is a reflex phenomenon.

The menstrual function is also affected by the nerve supply from this segment of the cord. From our experience in relieving nerves involved in menstrual disorders, we are convinced that the second pair of lumbar nerves also play an important part in the control of the functions of the uterus.

Lumbago quite frequently comes as a result of impingement of the second pair of lumbar nerves. The ordinary stitch in the back is a result of nerve-impingement, and also the tenderness of the muscles and ligaments, and the hyperesthesia and pain are direct results

of the condition of the nerves; especially is this true if the nerve lesion causes over-excitability of the nerve. On the other hand, there is weakening of the nerve tone; the spinal column will be weakened, due to the lack of tonicity of the muscles and ligaments, and this will sometimes cause curvature, or may simply cause aches or weakness of the back.

The spinal cord may be impinged in the neural canal by a subluxation of this vertebra, and this will affect the function of the segments below and an impairment of all nerves derived therefrom.

The second pair of lumbar nerves in connection with the first pair possess the vasoconstrictor control over the bowels and other abdominal viscera.

By an adjustment to relieve the second pair of lumbar nerves we control dysentery, diarrhea, and overcome relaxed and prolapsed conditions of the bowels that favor hernia.

The second pair of lumbar nerves supply the appendix and through them we control appendicitis. This we have noticed in clinical experience. In appendicitis, we always find the second pair of lumbar nerves tender and by an adjustment we relieve them. We have never failed to relieve acute appendicitis with one adjustment.

As the second pair of nerves supply the inguinal canal they are responsible for the integrity of these passages, and any interference with them will permit lesion such as hernia, and adjustment to remove interference with this pair of nerves often relieves hernia.

These nerves relieve hernia in two ways:

First, by giving tonicity to the supporting tissues of the bowels; and

Second, by vasomotor influence, contracting the musculature of the inguinal canal.

The second pair of lumbar nerves exert the most decided stimulating influence upon the erectile tissues of

the genital organs and stimulation of them gives strength to their functional activity.

THIRD LUMBAR NERVES.

THE third lumbar vertebra is large compared with its fellows, and its prominence for the attachment of muscles is well developed. Under normal conditions, its movements are comparatively great, but contraction of the ligaments from irritation or from disease will impair the movements.

The transverse processes of this vertebra are longer than those of the vertebræ above. There may be an abnormal approximation of this vertebra with either the second above or the fourth below, but more frequently only one articulation is involved.

The ligaments at this point are larger and stronger than those of the vertebræ above and the facets are also deeper. This portion of the spinal column is built stronger, because it is exposed to more strains than the other portions of the spine and also is subject to the superimposed weight of the body.

A contractured condition of the ligaments, because of their thickness and strength in this part of the body, is more potent in the production of lesions of the articulations of this vertebra, which is caused by their contraction. Ligaments that are injured, bruised, or in any way irritated, become tender, congested, and thickened and contractured, approximating the vertebræ and thinning the intervertebral disc, thus narrowing the intervertebral foramina.

As a result of an excitation of the nerves, the muscles are likewise contractured, and consequently they aid in overcoming the proper relation of the vertebræ to which they are attached. Probably the most important muscles, causing a contraction in the lumbar region, that are

affected by irritation of the third pair of lumbar nerves are the multifidus spinæ, erector spinæ, and the psoas magnus.

The effect of irritative lesions of the third lumbar nerves, because of impingement through muscular contraction, depends upon which muscle is most affected.

The multifidus spinæ when contracted will tend to draw the spine to one side. If the erector spinæ are contracted, the spine will be curved toward the affected side. A contraction of the psoas muscles tends to flex the thigh upon the abdomen.

The contraction of all these muscles will contract the intervertebral discs while approximating the vertebræ and tend to make the lumbar portion stiff; and the mobility, veins, arteries, and lymphatics may also be disturbed by narrowing of the intervertebral foramina, as described above.

As a result of lesions of this pair of nerves, the function of several nerves may be impaired. The anterior crural nerve is formed principally from the third pair of nerves and is derived from the third lumbar segment, but it also receives fibers from the fourth pair of lumbar nerves below and from the second pair above, and sometimes receives fibers from the first lumbar nerves.

Lesions of the third lumbar nerves will also affect the long saphenous; also the obturator nerve supply comes from this segment. The external cutaneous nerve is another branch of the third lumbar.

Branches from the third lumbar also join the aortic and hypogastric plexuses; branches join the gangliated cord of the sympathetic, so that this portion of the sympathetic may also become affected through interference with the third lumbar nerves.

The hemorrhoidal plexus, that supplies the rectum with motor, vasomotor, secretory, and sensory impulses, may also be deranged by interference with the third pair

of lumbar nerves; as a result of this, we may have hemorrhoids, diarrhea, proctitis, rectal ulcers, and may have spermatorrhea. The testicles and the uterine and prostatic plexuses are also affected by lesions of the third lumbar nerves.

Many pathological conditions of the uterus and prostate glands are the sequence of lesions of the third lumbar nerves. Sometimes considerable subluxations occur and of such magnitude as to cause pressure upon the cauda equina. In such cases paralysis may follow, and derangement of the organs supplied below this point is inevitable.

There will be affections of the bowels and bladder and paralysis of the vesical sphincter, accompanied by a dribbling of the urine. The lower bowel may be paralyzed, causing obstinate constipation. The sexual organs will also be affected, causing a loss of tonicity, and impotence.

Lesions of the third lumbar nerves are usually associated with aches, lumbago, sciatic rheumatism, and a general disturbance of the pelvic organs and the lower extremities. The third lumbar nerves especially affect and control the ovaries and testicles.

THE FOURTH PAIR OF LUMBAR NERVES.

THE body of the fourth lumbar vertebra is larger than any of those above it; it is decidedly kidney-shaped, the transverse diameter being much greater than the anteroposterior.

The transverse processes vary considerably in different cases; in some they are quite long and slender, while in other cases they may be short and rudimentary.

The spinous process is large and strong and in some cases, especially in very strong spines, they have articular facets on the tip of the process upon the upper and lower

borders where they come in contact with the spinous processes of the adjacent vertebræ.

The cartilages below this vertebra and those adjacent are quite thick and also very elastic as compared with the other intervertebral discs. As age advances, or as a result of the contraction of the ligaments approximating this to adjacent vertebræ, the intervertebral discs become thinned below this vertebra. The ilio-lumbar ligaments also attach to the transverse processes and their contraction may tend to cause subluxation of the fourth vertebra.

There is normally a decided mobility of the articulations of this vertebra. While the facets are deep and the articulations strong, rendering complete subluxation almost impossible, yet minor lesions of the normal approximation of this vertebra with adjacent ones are quite common, on account of sprains caused by movements of the articulations to a sufficient extent to strain or injure the ligaments.

This injury to the ligaments may be caused by a misstep, torsion, rotation, extension, or any extreme or excessive movement that will rupture some of the fibers of the spinal ligaments, which will cause them to become tender and to shorten and thicken, and the natural result is an undue approximation of the vertebræ and a narrowing of the intervertebral foramina, which may occur on one or both sides.

The fourth pair of lumbar nerves make their exit from the neural canal and lumbar region through the intervertebral foramina, formed by notches in the adjacent sides of the pedicles of the fourth and fifth lumbar vertebræ.

They ramify and supply motor, trophic, thermic, sensory, and vasomotor functions to the organs which they ramify; they connect with the nerves, both above and below, in the formation of nerves which ramify the pelvic cavity and the lower extremities.

The large part of these nerves unite with the fifth pair of lumbar nerves and sacral nerves to form the great sciatic nerves.

This pair of nerves supply chiefly the muscles to the anterior and inner side of the thigh; also the gluteus muscles, more especially the medius and minimus muscles of the gluteous region.

These nerves also supply the quadratus femoris; they also supply some of their fibers to the muscles of the back of the body and to the back of the lower limbs.

Some of the principal organs that are chiefly supplied by this pair of nerves are as follows: the uterus, fallopian tubes, vagina, prostate gland, and vas deferens; the above organs being supplied mostly through the pelvic ganglion of the sympathetic. The seminal vesicles and the rectum also receive filaments from this pair of nerves. Fibers also supply the knee-joints, hip-joints, and ankle-joints, and possibly most of the articulations of the bones of the feet come from the fourth pair of lumbar nerves.

The genital centers of the spinal cord are found in the fourth segment of the lumbar portion of the cord. These nerves principally control the circulation of the blood in the uterus and the action of the lower bowels and affect the erectile tissues of the genital organs.

As a result of interference with this pair of nerves, you may have disturbance of the menstrual flow, and if the lesion is irritative in effect, you may have a hyperesthetic condition and painful menstruation; also, you may have contraction of the muscles of the gluteal region and of the back of the thigh and of the calves of the leg; and also may have pain in the hip, knee, or ankle-joints.

Impingement of these nerves also causes derangement of the functions of the genital organs, or inhibition of the normal transmission of impulse may cause weakness, impotence, sterility, barrenness, also constipation and hemorrhoids; and in the case of young persons there

may be improper development of the external genitalia and spermatorrhea may occur.

The posterior subluxation is very rare, but may be caused by straining or lifting while in a condition of extreme flexion.

THE FIFTH LUMBAR VERTEBRA AND NERVES.

THE forward subluxation of the fifth lumbar is the natural result of the shape of its body and of the superimposed weight.

The fifth lumbar nerves make their exit from the neural canal beneath the pedicles of the fifth lumbar vertebra. These nerves send branches to the fourth pair of lumbar nerves above and to the sacral nerves below, and also join the pelvic plexus and other terminal plexuses in relation with the pelvic organs.

All the nerves which receive filaments from this pair of nerves may be affected by lesions of them. Some of the principal nerves receiving filaments from the fifth lumbar pair are the superior gluteal, inferior gluteal, and the nerves supplying some of the larger muscles and the great sciatic nerve.

Some of the muscles that may be affected by lesions of this nerve are the erector and multifidus spinæ, obturator internus, and quadratus femoris; and as a result of impingement of this pair of nerves we may have interference with the lower part of the large intestines, and especially rectal troubles, and also affections of the knee and ankle joints, and in extreme cases we have severe rheumatic conditions, and also paralysis of the lower extremities.

Diagnosis of lesions of this vertebra are made by detecting tenderness over the spinous process and by tenderness over the intervertebral foramen, due to a

tender condition of the nerves and by contraction or tenderness of the muscles in that immediate region, and by the approximation or lateral position indicated in the alignment of all the processes of this and adjacent vertebræ.

The fifth lumbar vertebra is one of especial importance on account of the frequency of its subluxation. Between the fifth vertebra and the sacrum is an articulation that is weak from two or three considerations.

First, the body of the fifth vertebra is quite wedge-shaped, owing to the excessive thickness of the front part of the vertebra over that of the posterior border of its body; second, because at this point of the spine the same condition exists as at the union between the first lumbar with the twelfth thoracic vertebra—namely, a movable vertebra articulating with a more or less immovable segment; third, there is still another cause tending to produce subluxations of the fifth lumbar, and that is, the superimposed weight of the body and the tendency of any force or jar that is applied to the upper part of the spine being transmitted to and expended upon the lower vertebra of the spinal column, or, rather, upon its articulation with the sacrum.

These unfavorable conditions are, however, partly overcome by the extra strength and thickness of the lumbo-sacral ligaments and other ligaments that hold the fifth lumbar vertebra in apposition with the sacrum.

The lesions of this lumbar may be anterior or posterior, or there may be slight torsion.

Lumbar Plexus.—The short trunk of the anterior division of the first lumbar nerves, having given off twigs to quadratus lumborum, divides behind psoas major into two branches. The upper one is joined by a branch from the twelfth thoracic nerve. From the new nerve thus formed two new nerves are derived: ileo-inguinal and ileo-hypogastric. The lower one passed behind psoas

and unites with the anterior division of the second lumbar nerve. This division is longer than the former one, and gives off a branch which is joined by a branch from the anterior division of the third lumbar nerve, and another one from the fourth lumbar anterior division. Thus the obturator nerve is formed. From the connection between first and second anterior divisions results the genito-crural nerve. The rest of the anterior division of the second lumbar nerve partly joins the third anterior division, partly a branch from that division. This latter junction forms the external cutaneous nerve.

The anterior division of the third lumbar nerve gives off a branch to the fourth lumbar anterior division, a branch to the obturator nerve, another to the external cutaneous nerve, and ends by joining the fourth anterior division after having received the communicating branch from the second division.

The anterior division of the fourth lumbar nerve sends a branch to the fifth obturator nerve, and joins the two branches described of the third division to form the anterior crural nerve.

The lumbar plexus lies in front of the transverse processes of the lumbar vertebræ, embedded partly in the psoas major, which is pierced by the greater part of its branches.

This plexus supplies internal oblique, quadratus, lumborum, cremaster, and the muscles of the hip and thigh, with exception of those on the posterior aspect of that region.

The sensory distribution comprises the skin of the loin, the external genitals, and the anterior aspect of the thigh. Here it is limited externally by the outer border of biceps and internally by the inner border of semi-tendinosus, thus reaching on to the posterior aspect of the limb. Below, the sensory area extends beyond the knee on to the antero-internal aspect of the leg as far

as the inner border of the foot. Its outer boundary is a line passing from the outer border of the patella along the outer border of tibialis anticus; its inner limit extends on the posterior aspect of the leg as far as the outer border of the tendo-achilles and the middle of the inner head of gastrocnemius.

The branches of the lumbar plexus are:

1. Muscular branch.
2. Obturator nerve.
3. Ileo-inguinal nerve.
4. Genito-crural nerve.
5. Ileo-hypogastric nerve.
6. External cutaneous nerve.
7. Muscular branches to psoas.
8. Anterior crural nerve.

1. Muscular Branch to quadratus lumborum, from anterior division of first lumbar nerve, passes through psoas and supplies the quadratus lumborum.

2. Obturator Nerve.—This nerve arises from the second, third, and fourth lumbar nerves, as described above. It is formed within the psoas major, and emerges at its inner border. It passes behind the iliac vessels over the sacro-iliac joint to the obturator foramen, within which it lies above the obturator artery, and gives off a branch to obturator externus muscle and to the hip-joint.

Having left the foramen, it divides immediately into its two terminal branches:

(a) Anterior branch.
(b) Posterior branch.

(a) Anterior Branch passes over the upper border of obturator externus between adductor brevis and adductor longis, and then between longus and gracilis to the skin. It supplies the muscles mentioned, and ramifies in the skin covering the inner surface of the thigh.

(b) Posterior Branch pierces obturator externus

and goes to adductor magnus, supplying it. It also gives branches to the hip-joint, obturator externus, and adductor brevis.

3. Ileo-inguinal Nerve, smaller than the former, takes a similar course. Having pierced the aponeurosis of the transversalis, it passes downward and inward along the inguinal canal, emerges at the superficial inguinal ring, and ramifies in the skin, covering the middle of the groin, the mons pubis, and scrotum or labia majora. Like the ileo-hypogastric nerve, it is a mixed nerve, sending a few branches to the oblique muscles. It frequently sends a cutaneous branch to the anterior surface of the thigh.

4. Genito-crural Nerve arises, as explained above, from the anterior divisions of first and second lumbar nerves. It emerges between psoas and third lumbar vertebra, passes downwards and outwards on the muscle (internally to the tendon of psoas minor, if present), and divides at a variable distance from Poupart's ligament into its two terminal branches:

(a) Genital branch.
(b) Crural branch.

(a) Genital Branch.—Its course is directed more inward. The nerve passes, crossing in front of the larger vessels, to the inguinal canal, below the spermatic cord or round ligament, and descends to the testicle or labia majora. Where it leaves the superficial inguinal ring it ramifies in the territory of the ilio-inguinal nerve; it ends by sending twigs to the Cremaster, Dartos or labia majora.

(b) Crural Branch passes along the outer border of psoas, external to the genital branch. Above Poupart's ligament it splits into two or more branches, which pierce the transversalis fascia and fascia lata below Poupart's ligament, and become subcutaneous

externally to the saphenous opening. Their area does not extend as far as the middle of the thigh.

5. Ileo-hypogastric Nerve is the upper terminal branch of the first anterior division. It emerges from the psoas, passes on to the anterior surface of quadratus lumborum, and runs obliquely downwards to the iliac crest. It now pierces the aponeurosis of transversalis, and passes forwards between transversalis and internal oblique over the antero-superior spine. At the mid-point of Poupart's ligament it pierces internal oblique and aponeurosis of external oblique, and ends in the skin of the groin and mons pubis (hypogastric branch). In its course it gives fibers to internal and external oblique. Before reaching the antero-superior spine it gives off its

Iliac Branch, which pierces the internal and external oblique muscles, and passes over the iliac crest to the outer portion of the skin covering the hip region.

6. External Cutaneous Nerve is formed by the junction of branches from the anterior divisions of second and third lumbar nerves at the level of fourth lumbar vertebra. It emerges, either by piercing the psoas or at its outer border, below the fascia iliaca, and passes obliquely outwards and downwards over iliacus to the antero-superior spine. Below the latter it appears under Poupart's ligament, internally to sartorius, gives branches to the area supplied by the crural branch of genito-crural nerve, and divides into two branches, which pierce the superficial layer of the fascia lata, and thus become subcutaneous. The smaller, outer branch ramifies in the skin over the great trochanter; the larger, inner branch runs along the anterior border of vastus externus to the knee, supplying with many filaments the outer surface of the thigh.

7. Muscular Branches to Psoas: two or three from the lower branch of anterior division of first lumbar nerve.

8. Anterior Crural Nerve comes, as described above, from the anterior divisions of second, third, and fourth lumbar nerves. This is the largest nerve derived from the lumbar plexus. It emerges at the outer border of psoas, and passes behind the fascia iliaca in the furrow between the iliacus and the psoas portion of the ilio-psoas. It runs under Poupart's ligament, approaching gradually the large vessels. Below the ligament it lies to the outer side of the femoral artery, and splits soon into its terminal branches. Its branches are:

1. Muscular branches to ilio-psoas.
2. Muscular branches to pectineus, rectus femoris, vastus externus, crureus and vastus internus.
3. Long saphenous nerve.
4. Middle cutaneous nerve.
5. Nerve to femoral artery.
6. Internal cutaneous nerves.

1. Muscular branches to ilio-psoas above Poupart's ligament.

2. Muscular branches to pectineus, rectus femoris, vastus externus, crureus, and vastus internus. The first branch given off is the one to rectus femoris. The branches to the triceps extensor usually run for some distance in their muscles, and give filaments to the knee-joint.

3. Long saphenous nerve. Covered by sartorius, it runs at first externally to the femoral artery, and then in Hunter's canal in front of that vessel. By piercing the anterior wall of the canal, it leaves the artery and passes under the deep fascia, between abductor magnus and internal vastus, to the inner surface of the knee. Here it pierces the fascia behind the tendon of sartorius, and follows the long saphenous vein along the internal surface of the leg to the inner border of the foot. Its branches are:

(a) Infra-patellar branches.
(b) Cutaneous branches.

(a) Infra-patellar branches, one or two, given off at the internal condyle; one perforating sartorius and supplying the skin over the patella, the other passing over that muscle to the skin below the knee.

(b) Cutaneous branches given off in the leg, which ramify on its anterior and internal surfaces.

4. Middle cutaneous nerve, one or two branches running along the posterior surface of sartorius, supplying it. They pierce that muscle, or wind round its inner border, and ramify in the skin covering the anterior aspect of the thigh.

5. Nerve to femoral artery arises also above the ligament, and goes to the femoral artery. A branch passes with the profunda femoris artery to the nutrient foramen of the femus.

6. Internal cutaneous nerves. Two or three nerves which pierce at various levels, externally to the saphenous vein, the fascia lata, and ramify in the skin on the anterior aspect of the thigh.

PART SEVEN.

SPONDYLOTHERAPY METHODS.

CHAPTER I.

NERVE SUPPLY AND TREATMENT.

IN this chapter we wish to enumerate the principal regions or zones of the human organism, and to briefly indicate the nerve supply to the special zones that are affected in case of disease, and the treatment that should be given to remove all interference with the nerve supply and thus restore the normal functional activity and health to the diseased areas.

We will not enumerate the diseases to which the different zones are liable, nor do we find this necessary since the function of any zone or part is dependent upon the integrity of the nerve supply, hence removing interference with the integrity of nerves is effective against all disease.

Normal nerve supply is necessary to normal function, and normal impulse can never be had except when all interference with nerve supply has been removed. Nerves are subject to different amounts and quantities of interference and organs or parts of the body are liable to different forms of disease.

There are different exciting causes of disease which in a great measure account for the different forms and manifestations thereof. All forms of abnormal function or disease are permitted or caused by an interference and deviation from the normal condition of the nerve supply. We fully believe that the restoration of normal nerve supply will be necessary to remove the permitting condition or predisposing as well as often the direct exciting cause of deranged function or disease.

In this chapter it is our intention to call to mind the principal regions or zones of the body, and mention the segments of the spine that should be treated by spondylotherapy methods in order to remove interference with the nerve supply to the different zones, and to stimulate them to sufficient functional activity to cause the restoration of health.

DISEASES OF THE ANKLES.—The sciatic nerves supply the ankles and usually that portion of the sciatic nerves which come from the fifth lumbar pair of spinal nerves.

Adjustment: The lower lumbar, especially the fifth.

DISEASES OF THE AORTA.—The nerve supply having the most influence upon the thoracic and abdominal aorta is the second pair of thoracic nerves which originate from the second segment of the thoracic portion of the spinal cord, which is situated under the spinal process of the seventh cervical vertebra.

Adjustment: For the relief of interference with the principal nerve supply adjust the second thoracic vertebra.

Stimulation: For stimulation of the origin of the principal nerves of the aorta, use concussion over the seventh spinal process for vasomotor and myoconstrictor effects. The length of time of percussion and stimulation with the writer varies from five to ten minutes.

DISEASES OF THE APPENDIX.—Diseases of the appendix are permitted or caused by, in most, if not all cases, by an interference with the integrity with the second pair of lumbar nerves.

Adjustment: Adjustment of the second lumbar vertebra. Relief of the second pair of lumbar nerves upon the right side will give instant relief in any case of appendicitis, and will accomplish a speedy and permanent cure in a great majority of cases.

Stimulation: It is necessary to stimulate the nerve

centers to obtain relief from diseases of the appendix, but in case we desire so to do, we may apply concussion to the spinous or transverse process of the tenth thoracic vertebra.

DISEASES OF THE BLADDER.—The most direct and potent nerve supply affecting the bladder is from the first lumbar pair of nerves.

Adjustment: We should give a thrust to the spinous process of the first lumbar vertebra for relief of the first pair of lumbar nerves.

Should bladder trouble be caused by abnormal ingredients in the kidney secretions, then we thrust the tenth thoracic vertebra for the relief of the nerve supply to the kidneys.

Stimulation: This may be accomplished by percussion over the ninth thoracic or by spinal concussion to the spinous process of the fifth lumbar vertebra.

DISEASES OF THE BRAIN.—The brain is affected directly and indirectly by nerve supply from the spinal column. The upper cervical nerves affect the circulation and the integrity of the nerve supply to the brain and the investing membranes thereof. The middle cervical nerves, through the phrenic nerves, affect the expansion of the lungs and diaphragm, and indirectly affect the amount of blood in the cranial cavity.

Adjustment: We find it necessary to adjust the nerves in the upper cervical region from the first to the fourth pair, also we relieve interference with the function of the brain by removing interference with the upper thoracic down to the sixth thoracic pair, and also lumbar adjustment in some cases may be found necessary.

DISEASES OF THE COLON.—The colon receives nerve supply from several segments of the spinal cord.

Adjustment: The principal adjustment for the relief of diseases of the colon is the second lumbar in connection with the tenth and twelfth thoracic.

Stimulation: Vasoconstrictor effects may be produced by concussion over the second pair of lumbar nerves, or by percussion over the seventh spinous process.

Vasodilation may be caused by concussion over the eleventh thoracic spinous process.

Diseases of the Ear.—The nerve supply to the ears is principally from the upper cervical and upper thoracic pairs of nerves.

Adjustment: Relax the musculature of the upper cervical region by adjustment of the upper three vertebræ, also adjust the upper thoracic vertebræ from the second to central place, according to indications discovered by palpations.

Diseases of the Esophagus.—The nerve supply to the esophagus comes from the upper thoracic and lower cervical nerves.

Adjustment: From the fifth to the seventh cervical and from the first to the fifth thoracic as indicated.

Stimulation: Especial vasoconstriction and tonicity of the esophagus may be produced by concussion over the spinous or transverse processes of the seventh cervical vertebra.

Diseases of the Extremities.—We have the long nerve trunks reaching from the spinal cord to the upper and lower extremities.

Adjustment: For diseases of the arm adjust for the relief of the nerve supply forming the brachial plexus, that is, from the fifth cervical down to and including the second or third thoracic vertebræ.

For diseases of the lower extremities adjust for the relief of interference with the lower lumbar nerves by adjusting from the second to the fifth vertebræ.

Diseases of the Eyeballs.—Adjust the fifth thoracic vertebra for the relief of interference with the fifth thoracic nerve.

Stimulation: The fifth thoracic nerve may be stimu-

lated by concussion over the second thoracic vertebra. Percussion over the first to the fifth cervical vertebræ.

Diseases of the Eyelids.—Different diseases of the eyelids, as granulation, may be influenced by the adjustment of the tenth thoracic vertebra, which effect seems to be due to the action of this pair of nerves upon the skin function upon the entire body. Adjust also the middle cervical.

Diseases of the Eyesight.—The pupil of the eye is practically under control of the middle cervical region.

Adjustment: The fourth cervical vertebra.

Stimulation: Concussion over the spinous or transverse processes of the third cervical vertebra.

Diseases of the Face.—The nerve supply to the face is principally from the upper and middle cervical regions.

Adjustment: From the second to the fourth cervical vertebra, and also adjustment of the upper thoracic from the second to the sixth vertebræ inclusive. We should always adjust the tenth thoracic vertebra because of the influence of the tenth pair of thoracic nerves upon skin action.

Fevers.—By adjustment we reduce fever. First we stop the production of toxic elements which produce fever, which may be done by adjustment to restore normal nerve supply and normal vital resistance, which will check pathological processes. By adjustment we also stimulate the elimination of the toxic elements and thus remove the cause of disease.

Adjustment: Always locate the segment or segments of the cord in which we detect an undue elevation of temperature. Adjust these segments and also adjust the tenth thoracic vertebra because of its influence upon the elimination both through the skin action and kidney secretions.

Diseases of the Gums.—The gums are influenced

principally from the nerve supply from the two segments of the spinal cord.

Adjustment: The principal adjustment is the fourth cervical vertebra. We should always adjust the tenth thoracic vertebra.

Stimulation: Concussion over the seventh cervical spinous process.

Diseases of the Heart.—Different segments of the spinal cord through the nerves which they give off influence but in a different manner the condition and functional activity of the heart.

Adjustment: The principal adjustment for the heart is from the second to the sixth thoracic vertebræ, and the middle cervical vertebra. These different centers or segments of the cords through the nerves, which they give off, affect the heart as follows:

Adjustment of the fourth cervical vertebræ increases the myomotor and accelerator action of the heart.

Adjustment of the second thoracic vertebra, which relieves interference with the second pair of thoracic nerves, will re-establish the myomotor and vasoconstrictor tonicity of the muscles and blood vessels of the heart.

Adjustment of the fourth thoracic vertebra for the purpose of removing interference with the fourth pair of thoracic nerves will establish the normal myomotor and vasoinhibitory control of the functional activity of the heart.

Stimulation: Concussion over the third cervical vertebra will excite myomotor power, accelerate the action of the heart by stimulation of the origin of the fourth pair of cervical nerves, which originate in the neural arch of the third cervical vertebra.

Concussion over the spinous process or transverse processes of the seventh cervical vertebra will increase

the myomotor power and cause vasoconstriction of the musculature and vascular apparatus of the cardiac organ.

Concussion over the spinous or transverse processes of the first and second thoracic nerves would increase the myomotor power and establish the inhibitory control of the heart's action.

It is further claimed that concussion over the processes of the lower thoracic vertebræ from the eighth to the twelfth will produce vasodilation of the heart walls and vessels.

Diseases of the Kidneys.—The kidneys receive their nerve supply from the lower thoracic nerves and from the plexuses of the sympathetic system.

Adjustment: The principal adjustment for the kidneys is the tenth thoracic vertebra for the relief of the tenth thoracic nerves which have the most potent influence upon the functional action of the kidneys. Palpitate and adjust where indicated from the ninth to the twelfth thoracic vertebræ.

Stimulation: Concussion over the middle thoracic vertebræ will cause vasoconstriction.

Concussion over the lower thoracic or upper pair of lumbar will cause vasodilation and atonic action of the renal organs.

Diseases of the Larynx.—The larynx is affected mostly from the middle thoracic region.

Adjustment: The fifth thoracic vertebra and also the middle cervical vertebra.

Stimulation: Concussion over the spinous or transverse processes of the seventh cervical vertebra.

Diseases of the Liver.—The liver receives its principal nerve supply from the middle thoracic nerves and those immediately below.

Adjustment: Seventh thoracic vertebra, and to affect more of the nerve supply to the liver we adjust from the eighth or tenth up to the sixth thoracic vertebræ inclusive.

Stimulation: For constriction of the liver concussion should be applied to the processes of the first and second thoracic vertebræ for myomotor influence, and over the first and second lumbar for constriction of the liver.

For vasodilation of the liver, concussion should be applied over the spinous or transverse process of the tenth and eleventh vertebræ.

Vasoconstriction may be produced by concussion over the upper thoracic from the seventh cervical to the sixth thoracic vertebra.

Diseases of the Lungs.—The lungs are supplied and influenced by nerves from different regions of the spinal cord and the brain.

Adjustment: Upper cervical for the relief of the first and second cervical pair of nerves which join and influence the pneumogastric.

Adjust the middle cervical for the relief of the third, fourth and fifth cervical pair of nerves which form the phrenic nerves, which supply the pericardium, pleura and diaphragm.

Adjust the upper thoracic for the relief of the second pair of thoracic nerves, which supply and influence the bronchial tubes.

Adjust the third thoracic vertebra for the third thoracic nerves, which supply most directly the lungs and pleura.

Adjust from the fourth to the sixth thoracic vertebræ to relieve the lungs and the diaphragm.

Stimulation: Concussion applied to the fourth and fifth cervical vertebra, for the stimulation of the nerves originating in that region, will cause vasoconstriction and stop hemorrhages of the lungs.

Concussion over the middle thoracic vertebræ applied to the spinous or transverse processes of the fifth to the eighth will cause vasodilation of the pulmonary organs.

Diseases of the Ovaries.—The nerves which supply

the ovaries come from the lumbar nerves and the principal adjustment is the third lumbar vertebra.

Adjustment of any of the lumbar vertebræ according to indications of the existence of spinal lesions may be necessary.

Diseases of the Pancreas.—Adjustment: The principal adjustment for the deranging of the function of the pancreatic gland is the eighth thoracic vertebra.

Adjustment of other vertebræ of adjacent segments to the eighth may also be necessary.

Stimulation: Concussion applied to the processes of the fourth and fifth thoracic vertebræ will cause vasoconstriction.

Diseases of the Peritoneum.—The principal adjustment for diseases of the peritoneum is the second lumbar vertebra.

The peritoneum may be affected by adjustment establishing the integrity of the nerve supply from the sixth thoracic spinal segment down to and including the second lumbar, according to indications of lesions which may be determined by careful palpation.

Diseases of the Pharynx.—The nerve supply to the pharynx is similar to that of the larynx, and the adjustment is the same as for the larynx. See adjustment for larynx above.

Diseases of the Pleura.—The nerve supply to the pleura is similar to that of the lungs.

Adjustment: The pleura is most affected and controlled by the third pair of thoracic nerves. Also adjust the middle cervical.

Stimulation: Concussion applied to the fourth cervical will cause constriction. Concussion applied to the middle thoracic vertebra from the third to the eighth will produce dilation of the lungs and pleura.

Diseases of the Prostate.—The prostate glands

may be influenced from the lower thoracic nerves, through the lumbar nerves or through the sciatic nerves.

Adjustment: First lumbar, fourth and fifth lumbar vertebræ.

Stimulation: Concussion applied to the processes of the ninth and twelfth dorsal vertebræ.

Concussion over the twelfth is claimed to be the most potent in the treatment of prostatic hypertrophy.

Diseases of the Rectum.—Adjustment: Fifth lumbar vertebra and often dilation of the rectal sphincters is necessary. By dilation we can avoid operation.

Diseases of the Scalp.—The direct nerve supply to the scalp is from the upper cervical region.

Adjustment: The upper three cervical vertebræ should be adjusted for the relief of the nerve supply to the scalp.

Adjust the tenth thoracic vertebra, because of the influence of this pair of nerves upon the skin action of the entire body.

Diseases of the Sexual Organs.—The principal nerve supply to all the pelvic organs is from the lumbar nerves and from the lower thoracic nerves which contribute their supply by sending white rami communicantes which form the downward stream to the ganglionic cords sympathetic.

Adjustment: The principal nerve supply to the sexual organs is relieved by adjustment of the second, third and fourth lumbar vertebræ.

These organs are also influenced by adjustments which affect the lower thoracic nerves, which contribute the white rami communicantes, forming the descending stream, which passes downward in the gangliated cords of sympathetic system which supply the pelvic organs.

Diseases of the Small Intestines.—Adjust according to indications from the seventh to the twelfth thoracic vertebræ.

Stimulation: We may cause contraction of the small intestines by an adjustment of the second lumbar vertebra or by concussion applied to this segment.

We may produce dilation of the intestines by concussion over the eleventh thoracic vertebra with the pleximeter applied to either the spinous or transverse processes.

Diseases of the Spleen.—Adjustment: The principal adjustment for diseases of the spleen is the sixth thoracic vertebra for the relief of interference with the sixth thoracic pair of nerves.

Diseases of the Stomach.—The stomach lies just below the diaphragm and receives its nerve supply principally from near the center of the thoracic portion of the spinal column.

Adjustment: The fifth thoracic segment is called stomach place and our principal adjustment is for relief of the fifth thoracic pair of nerves.

We influence the stomach indirectly by adjustment of the upper cervical vertebræ, per the pneumogastric. The stomach is influenced reflexly because of the disturbance of the pelvic organs, which disturbance may be relieved by lumbar adjustment.

Stimulation: We may cause dilation of the stomach by concussion applied to the spinous or transverse processes of the eleventh or twelfth thoracic vertebræ.

Contraction of the stomach may be caused by concussion over the spinous processes of the upper two or three lumbar vertebræ and the second thoracic vertebra.

Diseases of the Suprarenal Capsules.—Adjustment: Ninth and tenth thoracic and fourth cervical vertebræ.

Stimulation: Percussion over the processes of the fifth, sixth, and seventh thoracic vertebræ will cause vasoconstriction.

Percussion over the eleventh and twelfth thoracic processes will cause vasodilation.

Diseases of the Teeth.—Adjustment: Fourth cervical and fifth thoracic vertebræ.

Stimulation: Concussion over the process over the seventh thoracic vertebra and the third cervical.

Diseases of the Throat.—The throat is influenced by direct nerve supply and also by an indirect nerve supply.

Adjustment: The fifth thoracic vertebra is the principal adjustment.

The throat is also influenced by the nerve supply from, and consequently the adjustment of, the middle and lower cervical regions.

Concussion may be applied over the seventh thoracic vertebra.

Diseases of the Thyroid Glands.—Enlargement of the thyroid glands and exophthalmic goiter may be helped and cured by spondylotherapy as follows:

Adjustment: Adjust the third and fifth thoracic vertebræ and also adjust the fifth and sixth cervical vertebræ.

Stimulation: Percussion should be applied over the spinous or transverse processes of the seventh cervical vertebra.

Diseases of the Tongue.—Diseases of this organ may be readily relieved by removing all interference with integrity of the nerve supply of this organ.

Adjustment: The fifth thoracic vertebra and also the middle and lower cervical vertebræ.

Stimulation: Concussion should be applied to the spinous or transverse processes of the seventh cervical vertebra.

Diseases of the Tonsils.—Adjustment: The treatment of the diseases of the tonsils is practically the same as that for the diseases of the tongue.

Diseases of the Uterus.—Adjustment: The principal adjustment of uterine diseases is that of the fourth lumbar vertebræ.

Stimulation: Constriction of the uterus may be produced by concussion applied to the thoracic or to the spinous processes of the upper two lumbar vertebræ.

CHAPTER II.

POINTS OF CONTACT.

IN this connection we call your attention briefly to the different points of contact of the hand used upon the processes of the vertebræ. We enumerate below the different forms of contact generally used in our work:

I. Thumb contact.
II. Ulnar contact.
III. Pisiform contact.
IV. Hollow of hand contact.
V. The finger ends contact.
VI. The ball of thumbs contact.
VII. The folded fingers contact.

I. Thumb Contact. (See Illustration, page 522).—This contact is used in the adjustment of the cervical vertebræ, and also in the adjustment of thoracic and lumbar vertebræ. The thumb is used in making contact with the spinous processes for the purpose of adjustment in the cervical and lumbar regions and also in the upper thoracic region.

In using the T. M. method and the rotary method in the cervical region we use the thumb contact. In the occipito-spinous method of adjusting the upper thoracic vertebræ, the thumb contact is used almost exclusively. We cross the thumbs and use them upon the transverse process of the thoracic vertebræ, but do not make any contact or give any thrust upon the transverse process of the lumbar vertebræ, because they are generally too light and slender.

The thumb contact is an easy method of adjustment of the thoracic vertebræ, but we should always be sure

Illustration of points of contact.

we make an adjustment of the vertebra and not be fooled by the click of the articulations of the ribs.

II. Ulnar Contact. (See Illustration, page 513.)—The ulnar contact may be used in giving adjustment in any portion of the spinal column. The ulnar contact is best adapted for use in the lower two-thirds of the thoracic region and in the lumbar region. In the use of the ulnar contact it is best to place the hand flat upon the patient's back, with the ulnar border superior, and upon the vertebra to be adjusted.

The flat hand will not excite the reflex contraction of the musculature of the spine, as is apt to be done if the hand is held on edge. The ulnar border of contact is used perhaps more extensively than any other method and has some advantages over the other methods of adjustment, provided the hand is held as it should be. Any portion of the ulnar border may be used from the little finger back to the pisiform process.

III. Pisiform Contact. (See Illustration, page 509.)—This contact is by no means a comfortable contact for the patient owing to the fact that the point of contact is too concentrated and sharp. This contact is most useful in lumbar adjustment in which there is a lateral inclination of a spinous process. This contact may also be used in giving the lateral thrust to the spinous processes of the upper thoracic vertebræ.

We do not use nor recommend the use of the pisiform contact in the adjustment of the thoracic vertebræ of the lower two-thirds except in case of lateral non-alignment of the spinous processes of vertebræ that are really rotated upon their axes because of unilateral contraction of the spinal musculature.

IV. Hollow of Hand Contact. (See Illustration, page 518.)—The hollow of the hand contact is one of the most comfortable contacts that we use and this contact has many advantages.

When using the hollow of the hand contact the hand should lie with the fingers extending superior and parallel with the line of the tips of the spinous processes. The spinous process to which the thrust is to be applied rests at the point indicated on the hand which is in the center of the hand and just below the metacarpal wrist articulations.

The ball of the thumb and the pad of muscular tissue on the anterior surface of the ulnar border of the hand will come in contact with the transverse processes on either side. In the use of the hollow of the hand contact we use also the ball of the thumb and the pisiform or ulnar contact; the latter two contacts being upon the transverse processes, while the spinous process is in contact with the hollow of the hand.

When the hand lies flat on the back as the patient lies upon the treatment table, with the fingers extending horizontal and superior, the feeling is very comfortable to the patient, and will not excite any reflex contraction that will tend to prevent the adjustment being easily made.

This contact may be used throughout the lower two-thirds of the thoracic region and in the adjustment of all the lumbar vertebræ except the fifth. In case the fifth lumbar vertebra is anterior this contact cannot be used except to the superior portion of the sacrum. In case of a posterior condition of the fifth lumbar, which is seldom if ever found, the hollow of the hand contact may be applied to give the thrust, the direction of which should be downward and forward.

This contact is one of the best that we use in giving the spinal thrust and it is a contact that gives absolute control as to direction of the thrust to be applied.

V. THE FINGER-ENDS' CONTACT.—In adjusting the cervical vertebræ by applying a thrust to the transverse processes, in loosening up all the cervical vertebræ

simultaneously, we use the ends of the fingers in contact with the posterior portion of the transverse processes.

We also use the ends of the fingers in palpating for tender nerves and in giving nerve pressure and in nerve tracing.

VI. The Ball of Thumb Contact.—This contact is used in making adjustment of the vertebræ of the lower two-thirds or three-fourths of the thoracic region, and may be used advantageously in the adjustment of the upper two or three lumbar. The ball of the thumb contact is made to the spinous process of the vertebræ to be adjusted. The hand, making the contact of the ball of the thumb, is reinforced by the other hand, with the ball of the thumb contact to the dorsal portion of the contact hand.

In using the ball of the thumb contact the fingers extend superior and outward from the line of the spine at an angle of some forty-five degrees. The entire palmar surface of the contact hand and the greater portion of the palmar surface of the reinforcing hand, are in contact with the surface of the patient's back. The specific point of contact is directly upon the spinous process, to which the thrust is to be given.

The broad expanse of the contact on the patient's back makes the sensation to the patient palliative, and tends to the relaxation of the spinal musculature, and in this way, the adjustment is made more easy of attainment, and practically free from discomfort and pain. This contact we consider our best contact throughout the region where it is adaptable, because of both the comfort of the patient and of the ease and control of the direction of the thrust.

VII. The Folded Finger Contact.—In the cervical we sometimes make adjustments by a contact of the folded fingers against the spinous and transverse processes.

The contacting portion of the fingers is the dorsal portion, between the terminal and middle phalangeal articulations. This contact furnishes a larger or more extensive contact than the ulnar border contact in giving cervical adjustments.

The uppermost portion of the contact should rest upon the spinous or transverse process of the vertebra to be moved, which movement is for the purpose of relieving the articulation, by opening it up, which is between the vertebra that is adjusted and the one immediately above.

This contact has some advantage in the cervical region for the reason that it is more extensive than the ulnar border and more narrow and adaptable than the entire palmar surface of the hand contact.

CHAPTER III.

SPONDYLOTHERAPY METHODS.

WE will, in connection, call your special attention to a few rules which should govern us in the administration of thrusts for the relaxation of ligaments affecting the integrity of the spinal articulations, and for the purpose of freeing tender nerves, after they have been located by palpation, in the different portions of the spine.

The proper point for the administration of the thrust, for the purpose of relieving a tender nerve, may be determined by the relation of the exit of the spinal nerve to the spinous process to which the thrust is given. We may palpate a tender nerve in the cervical region; we may palpate a tender nerve in the thoracic region; or, we may palpate a tender nerve in the lumbar region, and in each region we should thrust a vertebral process in certain relation to the tender nerve which may be either even with the nerve or below it, and this depends upon the region in which we are palpating and adjusting.

Now the specific manner of relieving the nerve in the different regions varies, owing to the fact that the relation of the exit of the spinal nerve to the process of the vertebra to be adjusted varies in the different regions owing to the length and the direction of the spinous process, and the shape of the body of the vertebra.

We may palpate a tender nerve on the left side of the spinal column; we may palpate a tender nerve on the right side of the spinal column; now, the direction of the application of the thrust will vary, according to the side upon which we palpated the tender nerve.

RELIEVING NERVES IN THE CERVICAL REGION.—First, we will suppose that we palpate a tender nerve

upon the right side in the cervical region. We may also palpate a slight rotation of the spinous process of the vertebra whose centrum is above or below the tender nerve.

If the spinous process of the third, fourth, or fifth vertebra of the cervical region is rotated to the left, then we will find tenderness of the nerve upon the same side.

The proper method of procedure is to rotate the vertebra whose spinous process is lateral, back into the proper alignment, which we do by a forward rotary thrust on the transverse process of the vertebra. The thrust is applied to the opposite side to which the tender nerve is palpated. Should we adjust by the old method, namely, turning the head to one side and then by giving a downward thrust on the cervical region, then we should observe the following rule:

Turn the face so that the side of the neck upon which we find the tender nerve, is turned toward the table, or downward; then give a thrust to the spinous process that is directly opposite the tender nerve, thrusting it downward. This will separate the vertebral articulation that is impinging and causing the tender nerve by opening the foramina through which the spinal nerve makes its exit.

The same rule will apply to all of the cervical vertebræ. We should always observe the one rule: *Always apply the thrust to the opposite side of the tender nerve, and to the spinous process that is on a level, or even with the tender nerve.*

We may also relieve a tender nerve in the cervical region by giving a thrust to the same side of the neck on which we find the tender nerve. In case we do so, we should apply the thrust to the spinous process immediately below the tender nerve. In this way we rotate the vertebra below the tender nerve on its axis, and open the

foramen that is narrowed, causing the nerve impingement.

Relieving Nerves in the Thoracic Region.—In the thoracic region we relieve nerves according to certain rules as to the process to which the thrust is given, but the rules for applying the thrust in the different regions of the thoracic portion of the spine vary. The following general rule will apply:

When we locate a tender nerve by palpation, *we may always relieve that nerve of its tenderness, and relieve the pain, should it exist, by applying a thrust to the first spinous process below the plane or level of the tender nerve.*

In the upper thoracic region, we will find the following exception to our rule, namely, the level of the nerve will correspond to the interspaces between two spinous processes; but in such cases we adhere to the rule to adjust the spinous process immediately below the level of the tender nerve.

The same rule holds true in the lower thoracic region, from the tenth to the twelfth pair of nerves inclusive. The tender nerve is even with the interspace between the spinous processes of the vertebræ immediately above it.

In the central portion of the thoracic region we usually find a tender nerve about even with, or slightly above a spinous process. In this case, we do not apply the thrust to the spinous process which is even with the tender nerve, for the reason that this will open up an articulation above the tender nerve. This fact is owing to the length and obliquity of the spinous processes in the middle thoracic region. In this case, we should proceed as follows:

Find the spinous process that is even with, or slightly below the tender nerve. Then apply the thrust to the spinous process below the one that is even with the nerve. The

thrust applied according to the above directions in the thoracic region, should be as follows:

Always apply the thrust so as to throw the spinous process adjusted toward the side of the tender nerve. You should vary the direction of the thrust from a straight downward and forward direction. If you should thrust this process in the opposite direction, you would increase the impingement and would fail to give relief from the nerve impingement. The following rule is simple and easy to remember:

Throw the spinous process below the level of the tender nerve, slightly toward the side of the tender nerve, and forward.

We may relieve a tender nerve in any portion of the thoracic region by adjusting the process below the one designated above. This, however, is not as specific and successful a way as the rule we have given.

Should you prefer, though, to relieve the nerve by adjusting the second process below the level of the nerve in the middle thoracic, then the thrust should be applied as follows:

Stand on the side of the tender nerve, and thrust the spinous process backward, downward, and from the side of the tender nerve.

We may relieve tender nerves in the thoracic region by applying the thrust to the transverse process and to do so we should observe the following rule:

First, give the thrust on the same side of the tender nerve.

Second, apply the thrust to the transverse process immediately over and above the tender nerve.

Third, thrust the transverse process downward and forward on same side and over tender nerve.

Relieving Nerves in Lumbar Region.—The relief of nerve impingment or nerve interference in the lumbar region, is more simple, because it is easier to comprehend the arrangement, but it is more difficult to open up the

lumbar articulations owing to the amount and strength of the musculature connecting and approximating the vertebræ. The rule to follow is simple:

If the nerve is tender upon the right side of the second lumbar spinous process, as it will be in appendicitis, and inguinal hernia, then the thrust should be given to the second lumbar spinous process, as a tender nerve even with it makes its exit from the neural canal between the centrums of the second and third lumbar vertebræ.

This thrust should be forward to open up the articulations, and it should be toward the right side or toward the tender nerve, to relax the tissues upon the right side of the spinal column.

Should the nerve be tender upon the left side, then the thrust should be toward the left side, and forward, that we may relax the tissues upon the left side of the lumbar vertebræ.

The rule in brief, to follow in all lumbar adjustments, is, viz., *apply the thrust to the spinous process that is even with the tender nerve, and to throw the process forward and slightly toward the side of the tender nerve.* This rule applies to the adjustment of all of the lumbar vertebræ. We should never attempt to adjust a lumbar vertebra by giving a thrust upon the transverse processes.

However, other methods than the direct thrust may be used in some cases. We may loosen up two or more articulations at one time. Should we attempt to relieve nerves in this way, we should follow the directions given in the preceding chapter on Methods of Spinal Adjustment.

SPECIAL RULES FOR GIVING THE THRUST.

THE manner in which a thrust is given may determine the success of the thrust.

First, in giving the direct thrust to a spinous process, we should use a contact that is not irritating or exciting

to the patient, so that we may avoid the excitation causing involuntary reflex muscular contraction.

If an adjustment is secured in spite of the contracted condition of the muscles it will be painful to the patient. Complete relaxation is the prerequisite that is desirable and necessary in giving adjustment with the least possible pain or discomfort to the patient. To secure relaxation sometimes, is difficult. We may secure relaxation in different ways, as follows:

1. Deep breathing.
2. By flexing the spine.
3. A change of position.
4. By diverting the mind.
5. Manipulating spinal tissues.

1. Deep Breathing.—The act of deep breathing calls for alternate contraction and relaxation of the muscles of respiration, and incidentally the attachment of the muscles, which have to do with respiration, affect the integrity of the tonicity of the spinal column.

If the patient is encouraged to take a deep breath and expand the chest while doing so, the muscles are contracted, and then if the patient exhales completely, there will be a complete relaxation of the muscles of respiration, and consequently we notice a relaxation of the spinal musculature. If the thrust is given at the end of expiration, it will be given when the spine is thoroughly relaxed.

In this way, we may be enabled to open up articulations that we cannot open up in any other way, for the reason that any spinal contraction tends to prevent adjustment.

2. By Flexing the Spine.—When the hand is in position, and we have the proper contact with the spinous process to which a thrust is to be given, we may bear down and flex the spine, and by relaxing and again flexing a time or two, the patient will begin to co-operate with us, and when he does, and relaxes the spine so that

it may be flexed, you may follow the pressure that flexes the spine, with the increased impulse of the thrust that makes the adjustment.

3. A Change of Position.—Changing position of the head or face from one side to the other, is a helpful method of obtaining relaxation.

If the point of contact of your hand is against the process to which the thrust is given, you may ask the patient to change the face to the other side of the table. When the head is raised to change the face, that movement of necessity will relax the spinal musculature.

While the relaxation is on, and while the patient's mind is diverted from the thrust, to the action of changing the face from one side to the other, the thrust may be given, and given successfully.

We have in our experience, had the head changed from one side to the other, while we gave one adjustment, and had the head turned to the other side while we gave another adjustment. Then we have had the patient remark, "I know what you did that for."

4. By Diverting the Mind.—Diverting the mind is another important measure to overcome any resistance on the part of the patient.

If, while you are placing the hand, you do so lightly, you may divert the patient's mind by talking to him about his symptoms, age, or any other subject in which you may be able to get him deeply interested. Diversion of the mind from the thrust helps in two ways:

1. If the mind is occupied by some interesting subject there will not be so much susceptibility to pain as if the mind is directed to, and expecting pain.

2. A diversion of the mind will cause the patient to relax better than if the mind is directed toward the point of contact.

5. By Manipulating Spinal Tissues.—Massage, kneading, vibration, or any palliative method of treat-

ment of the spinal column, preparatory to adjustment, tends to allay the nervous excitation and contraction of the musculature of the spinal column; hence such treatments are to be recommended before the thrust is given, to open up the spinal articulations.

Sometimes it is necessary to use hot applications or alternate hot and cold applications, together with massage and vibration, for several days before we try to give the thrust, especially to spines that are settled and contractured as a result of advanced life or chronic disease.

RULES FOR PREVENTING SORENESS.

ONE difficulty that is met with in the practice of spinal adjustment, is soreness which will be caused by relaxing contracted ligaments of the spine.

When ligaments are shortened so as to approximate vertebræ, they must of necessity be stretched to relieve the approximation. Stretching these ligaments or tendons of the musculature of the spine will injure some of the fine fibrilla. This will tend to produce a soreness. Soreness produces two bad effects, as follows:

1. Contraction of the spine.
2. Prevention of treatment.

According to the law of contraction of any tissues, injury to the fibers thereof will excite a contraction. We may give a thrust to-day and loosen an articulation. In some cases the soreness produced thereby will cause a contraction by to-morrow. The good we have done is only temporary. After the subsequent contraction, following the adjustment, our patient will be no better than before treatment. This should be understood by the practitioner, and explained to the patient, especially when there are contractions of any consequence to be relieved. We may lessen the amount of soreness by certain precautions.

Kneading, massage, vibration, hot application, etc., to prepare the spine for adjustment, will prevent the soreness that would result without such preparation. Vibration following the adjustment, tends to prevent the development of soreness in the spinal musculature, and a Faradic current of electricity is claimed to be the best preventive against soreness from adjustment that has yet been discovered.

One mistake that is often made by practitioners of spinal adjustment, is that they give their adjustments too frequently. Most people practicing spinal adjustment will treat their patient's spines daily. Some will administer spinal adjustment twice daily, and the limit has been reached by some who teach that adjustment should be given every ten minutes in certain cases of acute diseases.

Common intelligence would teach a person better than this, and our experience has taught us that in typhoid fever that one adjustment per day is better than two, and we have further learned by experience that adjustment on alternate days is better than adjustment on every day, in the great majority of cases of chronic disease.

An adjustment given every other day does not cause that soreness and reaction that is excited by the daily adjustment. Patients will build up in strength and should improve from day to day if the adjustments are given on alternate days. Whereas, if they are given every day, we find that the patient often runs down under the treatment and will fail to improve in health until after they have discontinued treatment. After discontinuing their treatment, the gradual gain in many cases is greater than while being adjusted.

No doubt the adjustments are responsible for the improvement, but they do not receive the credit. The impression of the common mind is, that "I did not do

well while I was taking treatment, but I am getting along very well since I quit." They cannot see the connection between the loosening up of the spinal column and their subsequent improvement of health. Some of our most successful representatives in spinal treatment adjust all their patients only on alternate days.

CHAPTER IV.

EXAMINATION OF URINE.

By W. H. Vawter, Ph. G., D. C.

URINE is the most important excretion of the animal organism, and a careful analysis may furnish much valuable information relative to body metabolism, qualitatively by the appearance of abnormal substances in the excretion, and quantitatively by the variation of its normal constituents, and we are thus greatly enlightened as to facts bearing on diagnosis and prognosis.

We will here attempt to outline in a very brief manner the most important points to be considered from a physical and chemical standpoint, and describe some tests for the most important abnormal constituents, and which may be utilized with the minimum amount of apparatus and experience.

SELECTING A SPECIMEN OF URINE.

IN obtaining a specimen for examination, it should preferably represent the mixed urine voided in twenty-four hours, as the specific gravity, reaction, etc., are known to vary during this period.

When this is not possible the selection must be determined by circumstances, it being well to remember that abnormal substances, existing only in traces, are more readily detected from a specimen taken about three hours after a hearty meal. For some purposes an absolutely fresh specimen is required.

CHARACTERISTICS OF NORMAL URINE.

RECENTLY voided normal urine may be described as a transparent aqueous fluid, color light yellow to dark straw or brownish yellow. Reaction acid usually. Specific gravity 1015 to 1025. The odor can only well be indicated as characteristic. The solid constituents are principally urea together with earthy phosphates and other salts.

Quantity voided in twenty-four hours from 1000 C. C. to 1500 C. C.

AS TO TRANSPARENCY.

THIS is quite constant in freshly voided normal urine. It does not necessarily follow, however, that, from the fact that a given specimen of urine is transparent, it is normal.

Normal urine, transparent when voided, commonly develops, after standing a few minutes, a light cloud floating somewhere between the top and bottom, and gradually settles. This is composed of mucus and a few epithelial cells, and is not abnormal.

At certain hours of the day, some two or three hours after a heavy meal, the freshly passed urine may be turbid from the presence of earthy phosphates. These shortly after voiding begin to subside and usually within an hour have formed a bulky precipitate, leaving a clear supernatant liquid.

To determine the nature of such sediment a few drops of nitric acid may be added, when it will be immediately dissolved if it be earthy phosphates, or the application of heat will increase it.

The earthy phosphates require an acid urine to retain them in solution, a lessened degree of acidity may bring about their precipitation and this will be more pronounced by an alkaline reaction. The tendency toward alkalinity

always occurring during digestion it may readily be seen why this condition is usually observed at certain hours. The presence of the earthy phosphates as herein explained cannot be considered abnormal.

Through the precipitation of the urates, due to a considerable reduction of temperature after being passed, there may be turbidity. While readily soluble in water at body temperature the urates are promptly thrown out of solution by a reduced temperature in normal urine.

The precipitate subsides, as with the earthy phosphates, leaving a clear supernatant liquid, the precipitate having a white or pinkish-white appearance and not so bulky as that of the phosphates.

In testing this precipitate we find that the application of heat quickly dissolves the urates, while a sediment of phosphates is increased by heat.

Normal urine permitted to stand for some time undergoes ammoniacal fermentation, the reaction gradually changes from acid to alkaline and a bulky precipitate of phosphates and ammonium urate is formed, together with numerous bacteria. In this case the supernatant liquid is permanently cloudy, due to bacteria, which is not overcome by filtration.

This fact makes plain the necessity of examining fresh specimens of urine, especially in warm weather. The application of chemical as well as microscopical examination of sediment are far from satisfactory in a decomposing specimen and may lead to wrong conclusions.

Pathologically urine may be cloudy or more or less opaque, from the above conditions, in abnormal degree. From the presence of pus, which together with mucus will remain in suspension for several hours, mucus being absent it will subside quite rapidly.

The addition of an alkali to a sediment of pus converts it into a slimy, tough mass.

Pus suggests an inflammatory involvement of the genito-urinary tract.

CONSISTENCE.—Normally urine is always aqueous, that is, it flows freely and may be dropped readily like water.

PATHOLOGICALLY it frequently becomes viscid and separates into drops with great difficulty. This may be due to an excess of mucus or to pus and mucus, and usually occurs in an alkaline urine in which pus is present.

COLOR.—Normal urine may vary in color from light yellow to a dark straw or brownish-yellow, this variation in health depending on quantity voided and hence greater or less dilution of the pigments to which it owes its color.

PATHOLOGICALLY the color may vary greatly. It may be practically colorless in diabetes, nervous conditions, and chronic interstitial nephritis. In febrile conditions it is usually very highly colored. The urine is also colored after the administration of certain drugs. In case of blood in the urine, if specimen is recently passed, it will present a bright red color, if same comes from a hemorrhage in the urethra or neck of the bladder; while there will be a reddish-brown, sometimes smoky, precipitate should the blood come from the kidneys.

This occurs from the fact that in the latter case the blood has been in contact with the urine for some time, to which is due the darkened color through its effect on the hemoglobin.

In the former case the blood does not come in contact with the urine until same is voided, hence the bright red color. It is obvious that an absolutely fresh sample is essential to draw this distinction nicely.

THE REACTION of normal mixed urine, voided in a period of twenty-four hours, is acid, and usually specimens passed at any time of day give this reaction, though different in degree; after meals it may present a neutral or faintly alkaline reaction.

PATHOLOGICALLY increased acidity is usually observed in fevers, inflammation of liver, acute rheumatism, neurasthenia, and hyperchlorhydria.

In cases of undue retention, chlorosis, and marked general debility, the urine frequently presents an alkaline reaction.

Litmus paper is used for determining the reaction; acid urine turns blue litmus paper red and alkaline turns red litmus paper blue; neutral urine has no effect on the color of either.

THE SPECIFIC GRAVITY usually ranges from 1015 to 1025, varies as does the amount voided, and depends upon the quantity of solids in solution. The specific gravity may, however, be somewhat greater or less than above mentioned within the bounds of health.

PATHOLOGICALLY the specific gravity of urine is increased or decreased. It may be high with a large volume as in diabetes mellitus, or low with a small volume indicating incomplete elimination, as in the latter stages of acute disease and many chronic wasting diseases. The specific gravity should be taken from a mixed specimen, voided in a period of twenty-four hours, that the inference therefrom may be reliable.

To determine specific gravity readily and with a reasonable degree of accuracy the urinometer is used for routine work. An instrument of reliable manufacture should be selected and one with jar amply large to permit the urinometer to float with perfect freedom therein. All foam should be removed from the surface of the urine, care should be observed that the urinometer does not adhere to sides of jar, and float freely, reading should be carefully taken at lower meniscus. Urinometers are usually standardized at a temperature of 15 C., and specimen should have this temperature as nearly as practical.

When the specimen is not sufficient in volume to

float the urinometer, dilution may be made with an equal volume of pure water and the reading on the urinometer scale multiplied by two, or diluted with three volumes of pure water and reading multiplied by four.

ODOR.—We do not gain much of importance from this source. But little can be said of the odor of normal urine, other than it is characteristic, this, however, may be observed to vary somewhat in intensity, perhaps largely due to the degree of concentration.

Urine which has been standing exposed, especially to warm temperature, acquires an ammoniacal odor through fermentation and putrid through decomposition of mucus and other organic matter. The peculiar odor of certain drugs and vegetable foods are very readily imparted to the urine.

PATHOLOGICALLY little of clinical value is gained from this source. A peculiar sweetish odor is commonly observed in diabetic urine, and the ammoniacal and putrid odors heretofore mentioned, if detected in freshly voided urine, suggests in the case of the former decomposition in the bladder and is frequently associated with cystitis; a putrid odor is usually associated with pus.

THE AMOUNT voided in health may vary greatly from many causes, such as quantity of fluids or varieties of food ingested, and the greater or less elimination of water through the skin, bowels, and lungs. The limit is usually placed at from 600 C. C. to 1800 C. C.

PATHOLOGICALLY the amount may vary from none at all, complete suppression, or just a few ounces as in acute Bright's disease, to several quarts as in diabetes and chronic interstitial nephritis.

THE AMOUNT OF SOLIDS normally excreted in the urine in twenty-four hours is sixty to sixty-five grams, and is quite constant. This determination may be made as follows: The total twenty-four hours' urine should be collected, measured, and the specific gravity carefully

taken from the mixed specimen. Multiply the last two figures of the specific gravity (carried out to four figures) by 2.33 (Trapp's Coefficient) which will give, with approximate accuracy, the number of grams of solid matter contained in 1000 C. C. The total amount of urine voided in the twenty-four hour period having been ascertained, the total solids in this quantity may be readily calculated.

If this estimate is made several succeeding days, and it is observed that the patient is eliminating much less solids than normal, venal inactivity would be indicated; especially would this be true in fevers when we have great tissue waste, and proportion of solids should be largely above normal and if not eliminated danger is present.

ALBUMIN.—Serum-albumin is the albumin usually found in the urine and this variety is always indicated when speaking of urinary albumin.

The presence of albumin in the urine can hardly under any circumstances be considered as a normal constituent, although the existence of a "physiological" albuminuria is claimed by some authorities; this, however, is transient in character and unimportant.

Albumin may vary in the urine from a mere trace to an amount which causes the specimen to become almost solid on boiling.

The principal conditions in which albumin is present in the urine, are: febrile albuminuria; functional albuminuria; albuminuria due to blood changes, as scurvy, purpura, severe anæmia, lead or mercury poisoning, etc.; neurotic albuminuria, after epileptic attacks, apoplexy, tetanus, etc.; congestion of the kidney; organic diseases of the kidney—acute and chronic, Bright's disease, amyloid and fatty degeneration, pyelitis, etc.; extra-venal albuminuria, when the urine may be free from albumin when secreted, but become mixed

with some albuminous material, such as pus, blood or lymph, from the time it issues from the venal tubules and the time it is voided from the bladder.

Tests for Albumin.—The urine should be perfectly clear, and if filter paper fails to overcome any turbidity, a small quantity of talcum added to the specimen and thoroughly agitated before filtration is attempted will usually overcome this difficulty.

Tests for albumin are numerous and all have more or less to recommend them; we have here selected two that have proven entirely dependable and are of the opinion that one or two tests, with which one has become thoroughly familiar, are more satisfactory than many.

HEAT AND NITRIC ACID.

A TEST tube partially filled with perfectly clear urine is heated to boiling over a flame; if a cloudiness becomes visible it is due either to albumin or earthy phosphates. If earthy phosphates, the cloudiness promptly disappears on the addition of a few drops of nitric acid; if albumin, it is permanent and may be increased.

It should be borne in mind that a very small amount of albumin may not be precipitated by heat alone, without the addition of nitric acid, and that earthy phosphates are precipitated by heat and redissolved on addition of nitric acid. If care is not exercised, a faint cloudiness, indicating a trace of albumin, may not be readily observed, and the tested portion should be compared with the original specimen against a dark background, when an extremely slight turbidity, if present, may be readily seen, which will settle after a short time. In the application of this test the addition of too little acid may fail to cause precipitation, and too much may redissolve the precipitate. It is quite essential that the amount of acid and urine be in proper proportion; the

use of about one-twentieth as much acid as urine will usually result most satisfactorily.

By always using the same amount of acid and urine we may form some idea as to quantity of albumin by the bulk of the precipitate and is especially useful for comparison.

Heller's Ring Test will usually indicate traces of albumin, and if properly applied is a very satisfactory one, but it is not as delicate a test as some we have mentioned.

Upon a convenient quantity of pure nitric acid, in a small test tube, an equal quantity of clear urine is carefully added, by allowing same to flow very slowly and gently down the side of the tube and overlie the acid.

If albumin is present a sharp white ring or zone will appear at the point of contact between the urine and acid, varying in thickness with the amount of albumin present.

This method is not entirely satisfactory from the fact that it is extremely difficult to avoid an admixture of the fluids, in which case the test is a failure.

However, there is a modification of this that has proven most satisfactory and is known as Boston's Pipette Method.

A piece of glass tubing about one-fourth inch in diameter and eight or ten inches long is used. With the finger pressed firmly over the upper end of the tube it is introduced into the specimen; by relaxing the pressure of the finger, urine is allowed to flow up in the tube to the distance of about one inch. Firm pressure being resumed the tube is removed from the vessel containing the urine, rinsed off carefully on the outside and wiped dry, then introduced into a test tube containing pure nitric acid to the depth of about two inches; the pressure of the finger is again relaxed, allowing the acid to run in.

Pressure is again applied and the tube carefully removed for inspection.

If properly applied, there should be a sharp line of demarcation between the two liquids, and if albumin is present, a distinct white ring will form at this point, varying in depth with the percentage of albumin. It should be borne in mind that a brown ring forms at this point in normal urine, and grows in intensity on standing, due to the action of the acid on the coloring matter of the urine, and should in nowise be confused with the white ring of albumin.

SUGAR.—The sugars of clinical importance found in the urine are principally glucose, in a few cases lactose. Maltose, levulose, inosite, and the pentoses may be rarely found, but their presence has little significance. Normal urine contains a trace of glucose, but so small that it does not interfere with any clinical tests.

The presence of sugar in minute quantities may be detected occasionally with those who are unable to digest large quantities of carbonaceous foods and have indulged to excess, but if persistent it is a most dependable symptom of diabetes mellitus.

TESTS FOR SUGAR.

OF the large number of tests for sugar, two have been selected, which for practical purposes will be conclusive of more satisfaction than less familiarity with many.

Albumin if present in specimen should be removed by boiling and filtration.

HAINE'S TEST.

THIS is a modification of Fehling's test, the solution is quite stable, can ordinarily be kept almost indefinitely, obviates the necessity of using two solutions, and is the best of the copper tests.

Formula.—Take copper sulphate pure thirty grains, distilled water one-half ounce; dissolve; add glycerine pure one-half ounce, liquor potassæ, five ounces.

Test.—Take about one dram of the solution in a test tube and boil over a flame; add two or three drops at a time, and not more than eight drops in all, of the urine to be tested, boiling after each addition.

If sugar is present a yellow, or yellowish-red, precipitate is thrown down. It is a wise precaution to always carefully observe that the test solution remains unaffected by boiling, before any urine is added, thus being assured that it is in perfect condition, and to not add more than eight drops of the suspected urine, otherwise pseudo-reactions sometimes occur which are confusing and misleading.

FERMENTATION TEST.

THIS consists in determining the specific gravity of the urine before and after fermentation and proves quite satisfactory as a quantitative test. Carbon dioxide and alcohol are formed as a result of the fermentation of sugar and the specific gravity is lowered thereby, both on account of the decomposition of the sugar and the production of alcohol.

It was established by Roberts that a decrease of 0.001 in the specific gravity, after fermentation, corresponded to 0.23 per cent of sugar. In performing this test, two six-ounce wide-mouth bottles may be used, filling each about three-fourths with the urine to be tested, which should be faintly acid and if necessary acidulated with tartaric acid; cork one bottle up carefully and see that it is kept free from contamination.

To the other add a piece of compressed yeast about the size of a pea and see that same is thoroughly subdivided by agitation; close this bottle with a cork in which

a small notch has been cut to permit the escape of carbon dioxide. Allow both bottles to stand at temperature of room, or preferably 70 to 75 degrees F., for twenty-four hours or longer, until fermentation is complete, which should be verified by a negative reaction with Haine's test. After fermentation is complete, filter and determine specific gravity carefully, also specific gravity of control test which was not subjected to fermentation.

The difference in specific gravity between the fermented and unfermented urine multiplied by .23 will give approximately the percentage of sugar.

In our brief treatment of this subject it will be observed that tests for normal constituents have not been considered. While they are occasionally of value, it is only when quantitative estimations are made, and such estimation made from a separate portion of urine, or that from a single day, disregarding many conditions that must be given consideration, can lead to no deductions of real diagnostic or prognostic value, and should as a rule be left to an expert or until one has mastered the subject quite thoroughly, or much time may be wasted and results attained that are unsatisfactory and misleading. Whereas information of much greater value may be gained by the more readily acquired and simply applied qualitative tests for the more important abnormal constituents.

The microscopic examination of urinary sediments, a most valuable and interesting branch of this work, has not here been considered from the fact that plates showing the character and appearance of sediments under the microscope are very essential for its study in a satisfactory manner; and for this class of work, as well as a more extended treatise on qualitative tests, together with quantitative estimations, the reader is referred to the many well-written works devoted exclusively to the subject of the examination of urine, in all its phases.

Enumerated below, are the apparatus and reagents required for the tests herein outlined:

Urinometer.
Test tubes, four and six inches.
Test tubes, rack and brush.
Glass funnels, two to three inch.
Spirit lamp or bunsen burner.
Glass tubing for pipette.
Wide mouth bottles, six ounces.
Small graduate or graduated cylinder.
Filter paper to fit funnels.
Litmus paper, red and blue.
Nitric acid, pure.
Haine's test solution.